Instruction Manual
760007-A
July 2003

Model NGA2000 PMD

Paramagnetic Detector Analyzer Module

ROSEMOUNT Analytical

EMERSON. Process Management

http://www.processanalytic.com

ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Rosemount Analytical representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product**.
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes**. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY**. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury**.

The information contained in this document is subject to change without notice.

Emerson Process Management

Rosemount Analytical Inc.
Process Analytic Division
1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
e-mail: gas.csc@EmersonProcess.com

http://www.processanalytic.com

EMERSON.
Process Management

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

PREFACE

INTENDED USE STATEMENT

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of the Model NGA2000 PMD and the System Accessories of the NGA2000 System.

DEFINITIONS

The following definitions apply to DANGERS, WARNINGS, CAUTIONS and NOTES found throughout this publication.

DANGER .

Highlights the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition or statement.

SAFETY SUMMARY

Some sections may describe equipment not used in your configuration. The user should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

DANGER

ELECTRICAL SHOCK HAZARD

Do not operate without covers secure. Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel.

For safety and proper performance this instrument must be connected to a properly grounded three-wire source of power.

DANGER

POSSIBLE EXPLOSION HAZARD

This equipment is not designed and should not be used in the analysis of flammable samples. Use of this equipment in this way could result in explosion and death.

NOTE

Apply leak test liquid to cell or detectors only as a last resort.

WARNING

POSSIBLE EXPLOSION HAZARD

Verify that all gas connections are made as labeled and are leak free. Improper gas connections could result in explosion or death. See Section 2-4c on page 2-3 for Leak test procedure.

WARNING

HIGH PRESSURE GAS CYLINDERS

This analyzer requires use of pressurized gas. See General Precautions for Handling and Storing High Pressure Cylinders, page P-4.

WARNING

PARTS INTEGRITY

Tampering or unauthorized substitution of components may adversely affect safety of this product. Use only factory documented components for repair.

WARNING

OVER-VOLTAGE SPIKING

If this Analyzer Module is used with a non-Rosemount Analytical power supply, adding Rosemount Analytical PN 90331 Current Protector in series with the 24 V positive line will prevent over-voltage spiking and resultant fuse flowing when powering up the instrument.

CAUTION

HAND INJURY HAZARD

Do not place hands or fingers in Platform front handles when the front panel is open. Dropping front panel while hand or fingers are inside either handle can cause serious injury.

CAUTION

OVERBALANCE HAZARD

This Analyzer Module may tip instrument over if it is pulled out too far and the Platform is not properly supported.

NOTICE

Software compatibility is necessary for all NGA2000 components in your system to work together. The version of your Platform's software must be equal to or greater that the version of any other module(s) for successful compatibility. If it is not, contact Rosemount Analytical at 800-433-6076 to order software upgrade kit PN 657150 for the Platform.

You can locate the version of each NGA2000 component as follows:

Platform Controller Board
Turn power ON.

The display will show "Control Module V2. ...". This is the software version.

Analyzer Module
Located on the right side of the Analyzer Module case.

I/O Module
Located on the backplane connector of the module. If no label is present, the module is Version 2.0.

GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

Edited from selected paragraphs of the Compressed Gas Association's "Handbook of Compressed Gases" published in 1981

Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202

Used by Permission

1. Never drop cylinders or permit them to strike each other violently.
2. Cylinders may be stored in the open, but in such cases, should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade when located in areas where extreme temperatures are prevalent.
3. The valve protection cap should be left on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.
4. Avoid dragging, rolling, or sliding cylinders, even for a short distance; they should be moved by using a suitable hand-truck.
5. Never tamper with safety devices in valves or cylinders.
6. Do not store full and empty cylinders together. Serious suckback can occur when an empty cylinder is attached to a pressurized system.
7. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
8. Do not place cylinders where they may become part of an electric circuit. When electric arc welding, precautions must be taken to prevent striking an arc against the cylinder.

DOCUMENTATION

The following NGA2000 PMD instruction materials are available. Contact Customer Service Center or the local representative to order.

760007 Instruction Manual (this document)

COMPLIANCES

This product may carry approvals from several certifying agencies, including Factory Mutual and the Canadian Standards Association (which is also an OSHA accredited, Nationally Recognized Testing Laboratory), for use in non-hazardous, indoor locations.

NRTL /C

97-C219

Rosemount Analytical Inc. has satisfied all obligations from the European Legislation to harmonize the product requirements in Europe.

CE

These products comply with the standard level of NAMUR EMC. Recommendation (May 1993).

NAMUR

This product satisfies all obligations of all relevant standards of the EMC framework in Australia and New Zealand.

N96

GLOSSARY OF TERMS

Analyzer Module

The module that contains all sensor/detector components for development of a Primary Variable signal; includes all signal conditioning and temperature control circuitry.

Backplane

The interconnect circuit board which the Controller Board, Power Supply, Analyzer Module power and network cables, I/O Modules and Expansion Modules plug into.

Control Module

The Operator Interface plus the Controller Board.

Controller Board

The computer board that serves as the Network Manager and operates the Display and Keypad.

Distribution Assembly

The Backplane and the card cages that hold I/O and Expansion Modules.

Expansion Module

A circuit board that plugs into the Backplane from the front of the Platform and performs special features not related to I/O functions.

I/O Module

A circuit board that plugs into the Backplane from the rear of the Platform. Has a connector terminal for communication with external data acquisition devices and provides an input/output function.

Operator Interface

The Display and Keyboard.

Platform

Any workable collection of the following: Controller Board, Power Supply, Distribution Assembly, Enclosure and Operator Interface.

Power Supply

Any of a variety of components that provides conditioned power to other NGA2000 components, from the Power Supply Board that plugs into the front of the Backplane in a stand-alone instrument to several larger ones that can power larger collections of modules and components.

Primary Variable

The measured species concentration value from an Analyzer Module.

Secondary Variable

Data placed on the network by a module regarding current status, e.g., sample flow, source voltage and other diagnostic information.

Softkeys

The five function softkeys located below the front panel display; they assume the function displayed directly above each on the display, a function dictated by software.

System

Any collection of Analyzer Module(s), Platform(s), I/O Module(s) and Expansion Module(s).

SECTION 1
DESCRIPTION AND SPECIFICATIONS

1-1 OVERVIEW

This manual describes the Paramagnetic Detector (PMD) Analyzer Module of Rosemount Analytical's NGA2000 Series of gas analysis components.

The PMD Analyzer Module is designed to continuously determine the concentration of oxygen in a flowing gaseous mixture. The concentration is expressed in ppm or percent volume O_2.

The entire Analyzer Module is designed as a slide-in module (if configured in stand-alone instrument fashion), removable from the front of the Platform, with gas connections made from the rear. All electronics relative to sample detection and conditioning are included in this module.

1-2 TYPICAL APPLICATIONS

PMD Analyzer Module applications include:

- process control
- continuous emissions monitoring systems (CEMS)
- industrial gas production
- fermentation process monitoring

1-3 THEORY OF TECHNOLOGY

Oxygen is strongly paramagnetic (i.e., capable of becoming a temporary magnet when placed in a magnetic field) while most other common gases are weakly diamagnetic (i.e., tend to be non-magnetic). See Figure 1-1 below.

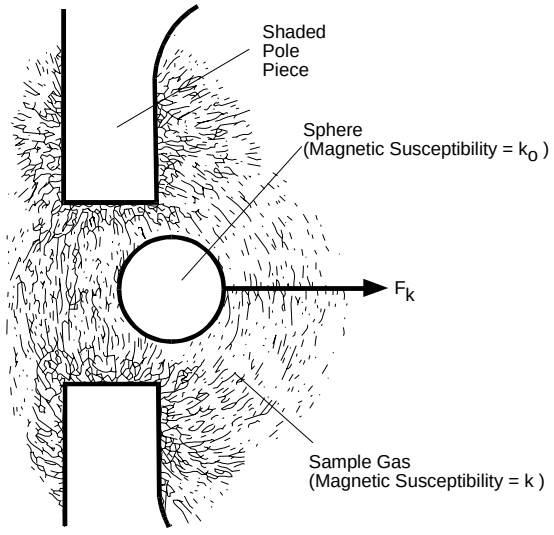
The Magnetic susceptibility of the flowing gas sample is sensed in the detector/magnet assembly. As shown in Figure 1-2 on page 1-2, a dumbbell shaped, nitrogen-filled, hollow gas test body is suspended on a platinum/nickel alloy ribbon in a non-uniform magnetic field.

Because of a "magnetic buoyancy" effect, the spheres of the test body are subjected to displacement forces, resulting in a displacement torque proportional to the magnetic susceptibility of the gas surrounding the test body.

Measurement is accomplished by a null-balance system, whereby the displacement torque is opposed by an equal and opposite restorative torque. The restoring current is automatically maintained at the correct level by an electro-optical feedback system. A beam of light from the source LED is reflected off the square mirror attached to the test body onto a bi-cell (dual photodiode).

The current required to keep the test body to the null position is a linear function of the total magnetic susceptibility of the sample gas.

See Figure 4-1 on page 4-1, Figure 4-2 on page 4-2, and Figure 4-3 on page 4-3 for component configuration.



Note:
As percentage of oxygen in sample gas increases, displacement force (F_k) increases.

Figure 1-1. Spherical Body in Non-Uniform Magnetic Field

1-4 FEATURES

Among the features incorporated into the PMD Analyzer Module is a flow splitter (≈2:1) that allows for greater sample flow, decreased lag time and faster analyzer response.

The "Time Alignment" feature can be used to delay sending the Primary Variable from the PMD Analyzer Module for up to 30 seconds in 0.1 second intervals. This feature allows Primary Variables form more than one PMD Analyzer Module to be "time aligned" if necessary.

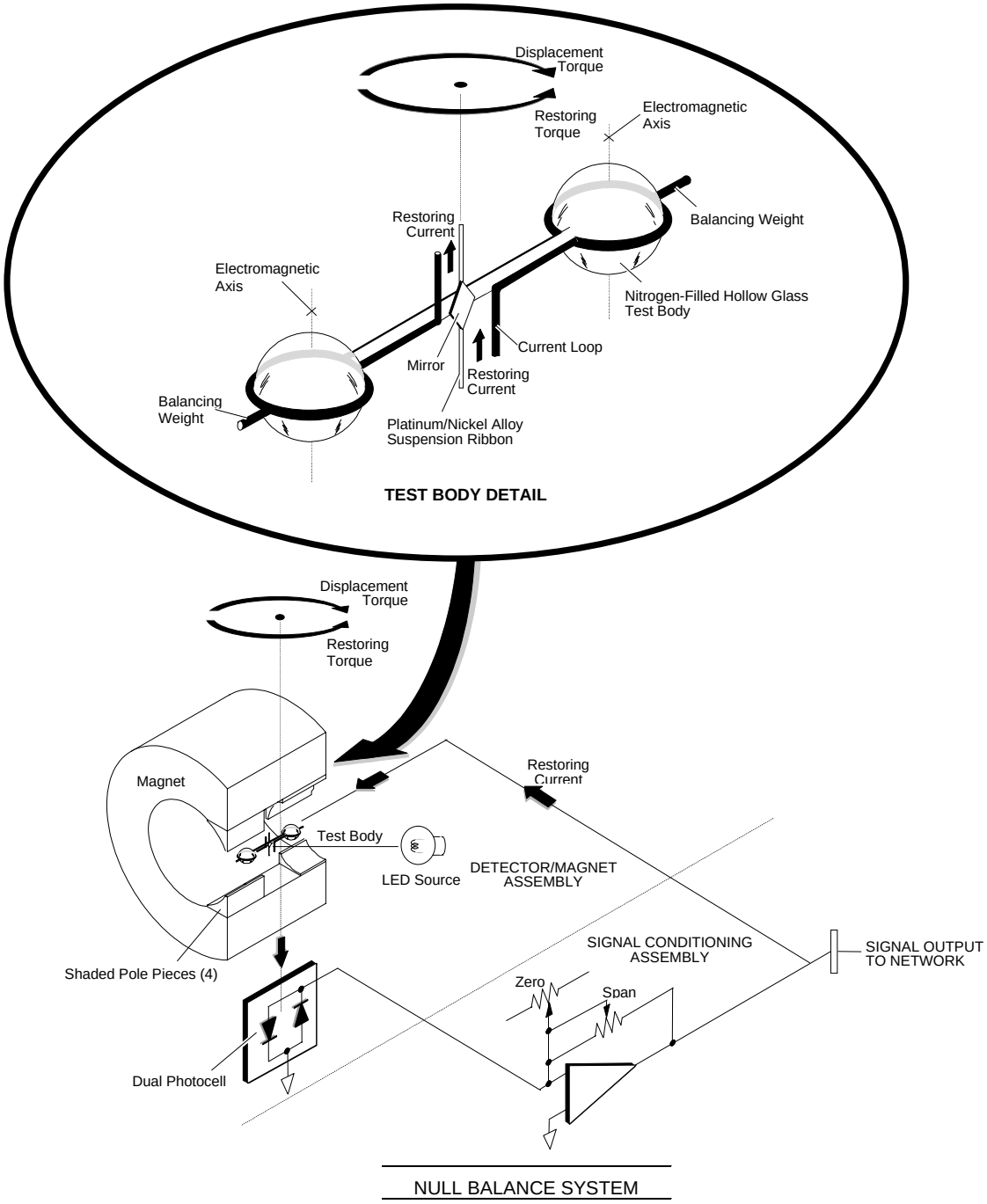


Figure 1-2. Trace Oxygen Detector Coulometric Principle

1-5 SPECIFICATIONS[1]

a. General

Measurement Species	Oxygen
Ranges	0 to 100% oxygen; four fullscale selections, including suppressed zero ranges in 1% increments
Repeatability	±1% of fullscale (at constant temperature)
Minimum Detectable Level	0.01% oxygen
Noise	<1% of fullscale, peak-to-peak; <±1% for suppressed ranges
Linearity	±1% of fullscale
Response Time	0 to 90% of fullscale in 20 seconds (±2 seconds)
Drift (Zero and Span)	<±1% of fullscale/24 hours, <±2% of fullscale/week at constant temperature; <±2% of fullscale/24 hours, <±4% of fullscale/week of range for 99 to 100% (at constant temperature)
Effect of Temperature	<±1% of fullscale over any 10°C interval for rate of change no greater than 10°C per hour
Environment	Location - Class B controlled, indoor, non-hazardous
Ambient Temperature	0 to 45°C (32 to 113°F)
Effect of Flow	<±1% of range when sample flow rate is changed by 20 ml/min.
Power Requirements	24 VDC ±5%, 50 W max.; ripple and noise: <100 mV peak-to-peak; line and load regulations: <±1%

b. Sample

Temperature	Non-flammable;: 10 to 66°C (50 to 150°F)
Flow Rate	800 to 1400 ml/min.
Exhaust Pressure	-345 to 690 hPa-gauge (-5 to 10 psig)
Particles	filtered to <2 microns
Dewpoint	below 43°C (110°F), no entrained liquid
Materials in Contact with Sample	Glass, 316 stainless steel, titanium, Paliney No. 7, epoxy resin, Viton A, platinum, nickel, rhodium and MgF_2
Sample Humidity	non-condensing at ambient temperatures

c. Physical

Case Classification	General purpose for installation in weather-protected areas
Dimensions	See Outline and Mounting Dimensions, Figure 2-6 on page 2-7
Weight	8 kg (17.6 lbs.
Mounting	Inside a Platform or custom-installed in a panel
Maximum Length of LON Cable	1600 m (1 mile) between Analyzer Module and Platform

[1] See the Platform manual for specifications regarding Platform related components.

SECTION 2
INSTALLATION

2-1 UNPACKING

If the Paramagnetic Analyzer Module is received as a separate unit, carefully examine the shipping carton and contents for signs of damage. Immediately notify the shipping carrier if the carton or contents is damaged. Retain the carton and packing material until all components associated with the Analyzer Module are operational.

2-2 ASSEMBLY

If the Analyzer Module requires assembly with other components (e.g., the Platform and associated I/O Modules), do so at this time. Following the guides on the bottom left and bottom center of the Platform, carefully slide the Analyzer Module halfway into place.

WARNING

HAND INJURY HAZARD

Do not place hands or fingers in the Platform front handles when front panel is open. Dropping the front panel of the Platform while hand or fingers are inside either handle can cause serious injury.

Lift the spring-loaded pins on the front of the Analyzer Module, and carefully slide it the rest of the distance. Secure the module in position by releasing the pins, which seat in the available holes in the bottom of the case (see Figure 2-1 below). If the module and Platform are difficult to assemble, remove the module, ensure the top cover of the module is firmly seated on the hold-down screws, and repeat the assembly procedure.

Install I/O Module(s) according to guidelines in the I/O manual. After startup and calibration have been performed, secure the front panel with the six screws provided.

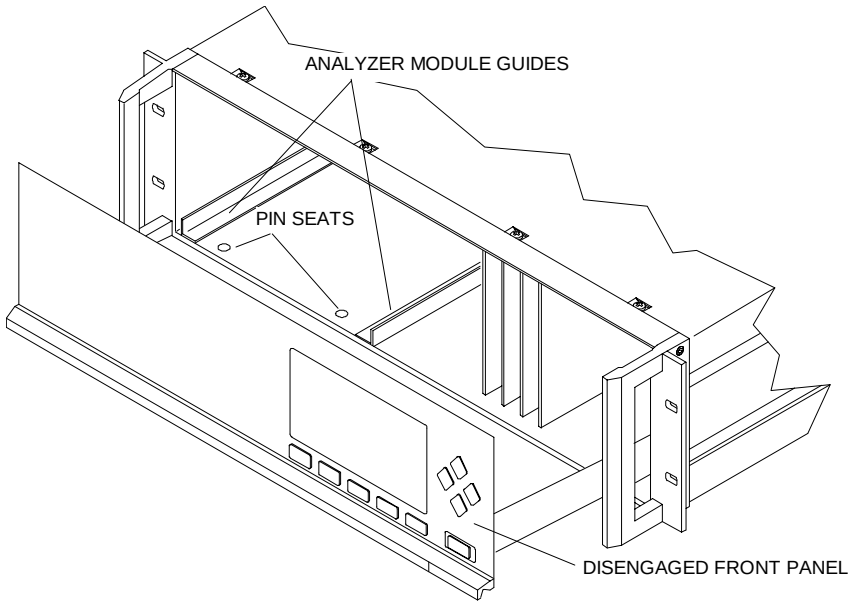


Figure 2-1. Analyzer Module Installation Into Instrument Platform

2-3 LOCATION

Install the Analyzer Module in a clean, non-hazardous, weather protected, vibration free location free from extreme temperature variations. For best results, either install the module near the sample stream to minimize sample transport time or supply a flow greater than necessary and route only the appropriate amount through the Analyzer Module.

Observing these requirements are critical. Note the following:

- Excessive vibration can cause a noisy readout. To minimize vibration effects, the detector/magnet assembly is enveloped in a shock-mounted compartment.
- The user should ensure, when making any internal electrical connections, that no cables are placed in contact with the detector assembly or associated internal sample inlet and outlet tubing.
- Magnetic susceptibilities and partial pressures of gases vary with temperature. Permissible ambient temperature range is 32°F to 113°F (0°C to 45°C).
- The interior of the Detector Assembly is maintained at approximately 144°F (62°C) by an electronically controlled heater. Prior to entering the detector assembly, the sample is heated in a coiled tubing to match the detector's temperature.

2-4 GASES

a. Requirements

Calibration Gases

Analyzer Module calibration requires the establishment of zero and span calibration points. This requires a zero standard gas to set the zero point span gas to establish a calibration point at or near the upper range limit.

An oxygen-free gas, typically nitrogen, is required for use as the zero standard gas. Recommendations for span calibration gases, bases on various operating ranges, are tabulated in Table 3-4 on page 3-10. Air (20.93% oxygen) can be used as span gas regardless of the ranges used for sampling, although very low ranges may lose accuracy.

Sample Gas

Sample gas should be non-flammable.

Temperature

Sample temperature at the inlet should be from 50°F to 150°F (10°C to 66°C). A maximum entry temperature of 110°F (43°C) is recommended to prevent cooling of the sample and possible internal condensation. Such condensation could damage some components of the Analyzer Module. This recommendation can be ignored if a thoroughly dry sample is examined.

Pressure

Sample exhaust pressure limits are -5 to 10 psig (-345 to 690 hPa-gauge). Normal operation is in the positive range, between 0 and 10 psig (0 and 690 hPa-gauge). Negative gauge pressures are not normally recommended, but may be used in certain special applications.

To prevent over-pressurization, insert a pressure relief valve into the sample inlet line. A check valve should also be placed in the outlet line if the Analyzer Module is connected to a manifold associated with a flare or other apparatus that does not operate at atmospheric pressure.

The outlet port is commonly vented to the atmosphere. Any change in barometric pressure has a directly proportional effect on the indicated percent of oxygen, and should be neutralized through manual or computer correction of data. Note the following example:

Range = 0% to 5% oxygen

Barometric pressure change after calibration = 1%

Analyzer Module measurement = 5% oxygen

Measurement error = 0.01 x 5% oxygen

Fullscale span = 5% oxygen

0.05% oxygen error = 1% of fullscale

The error is more significant for suppressed range 99% to 100%.

An optional barometric pressure compensation board is available to automatically perform this correction.

A general rule regarding calibration gas pressure is that it should be the same as the expected sample gas pressure during routine operation.

The above requirement increases the difficulty of operation at negative gauge pressure. A suction pump can be connected to the outlet port for drawing sample through the Analyzer Module. Such operation necessitates special precautions to ensure accurate readout, including the following:

The need for equilibrium between sample and gas calibration pressures.

Any leakage in the sample handling system will decrease readout accuracy.

Flow Rate

Recommended sample flow rate is 800 to 1400 ml/min., ±40 ml/min. Optimum flow rate is 1100 ml/min.

If flow is held to within tolerance and operating pressure remains constant, zero and span drift will meet specified limits.

b. Connections

(See Figure 2-3 on page 2-4) Connect inlet and outlet lines for sample gas to appropriately labeled fittings on the rear panel. Both connections are 1/4 inch ferrule-type compression fittings.

Zero and span gases use the same inlet and outlet as the sample. Figure 2-4 on page 2-5 shows a typical external sample handling manifold for gas selection. Particulates must be filtered down to two microns, gases generally require pressurization, and flow measurement metering MUST be present.

c. Leak Test

The Analyzer Module is thoroughly tested at the factory for gas leakage. The user is responsible for testing for leakage only at the inlet and outlet fittings on the rear panel. The user is also responsible for internal leak testing periodically and if any internal pneumatic components are adjusted or replaced (with a test procedure selected by the user).

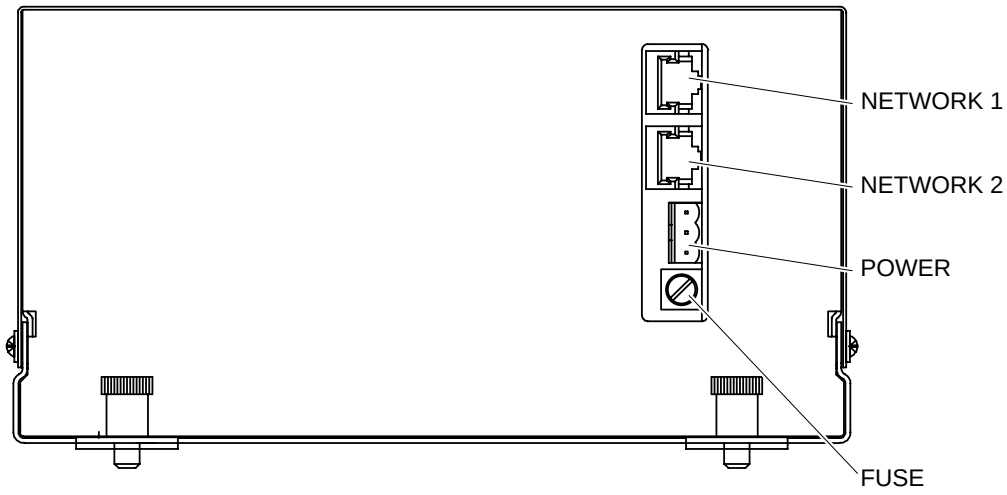
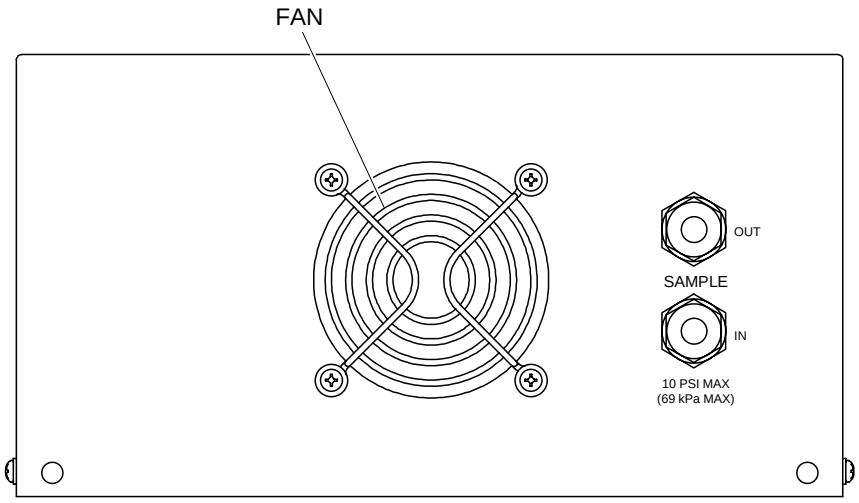


Figure 2-2. PMD Front Panel Connections



Note: Reference and purge gas connections are applicable only to certain applications.

Figure 2-3. PMD Back Panel Connections

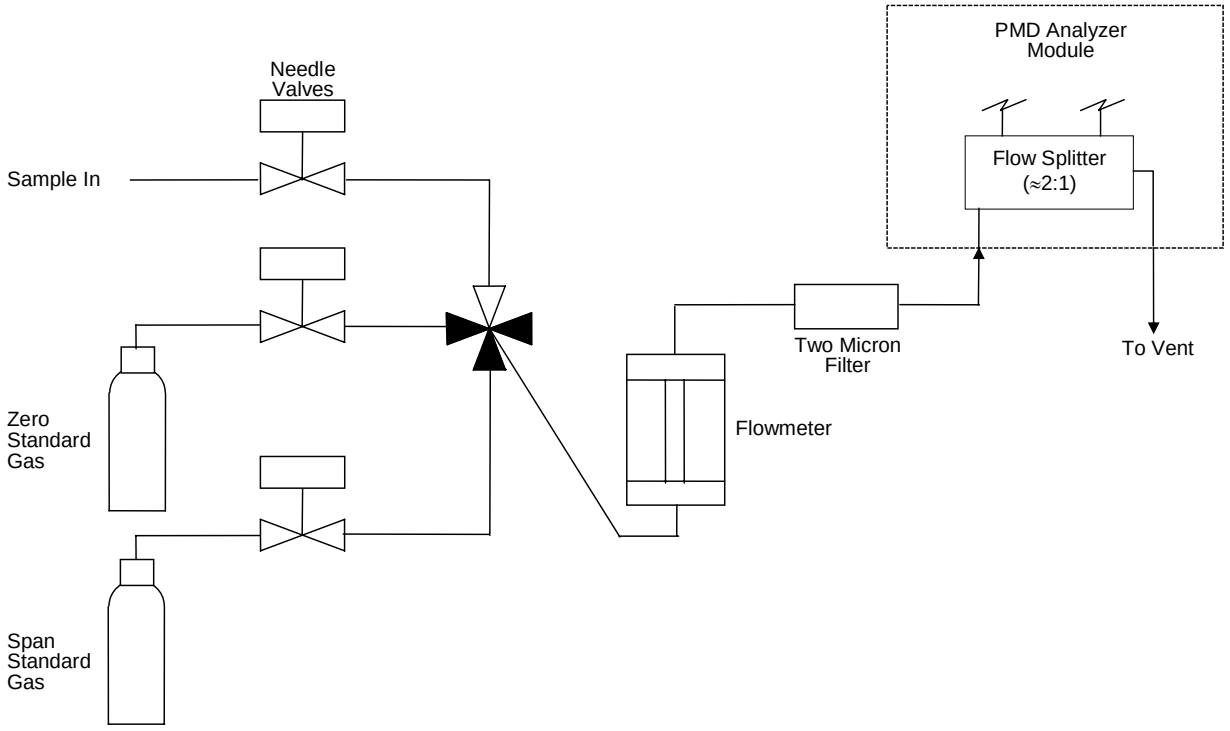


Figure 2-4. Interconnection of Typical Gas Manifold to PMD Analyzer Module

2-5 ELECTRICAL CONNECTIONS

NOTE

Electrical connections must be in compliance with National Electrical Code (ANSI/NFPA 70) and/or any applicable national or electrical codes.

Two electrical connections are required on the Analyzer Module; POWER and NETWORK.

See Figure 2-2 on page 2-4. On the Analyzer Module, two NETWORK connections are available, either of which is appropriate for : 1) interconnection with Backplane of the Platform (see Platform instruction manual) or 2) "daisy chaining" with other NGA2000 components.

Connect Analyzer Module POWER 24 VDC power source, either the Platform or external power source.

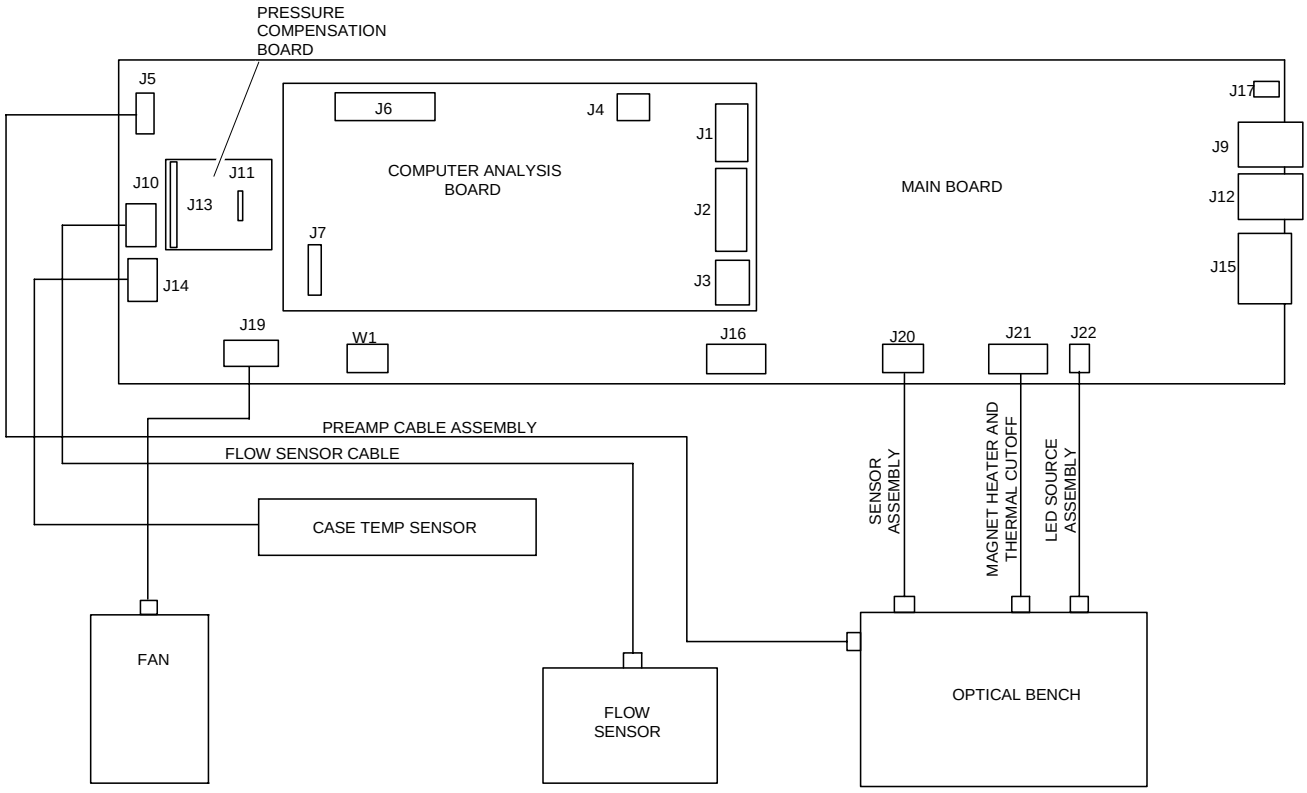
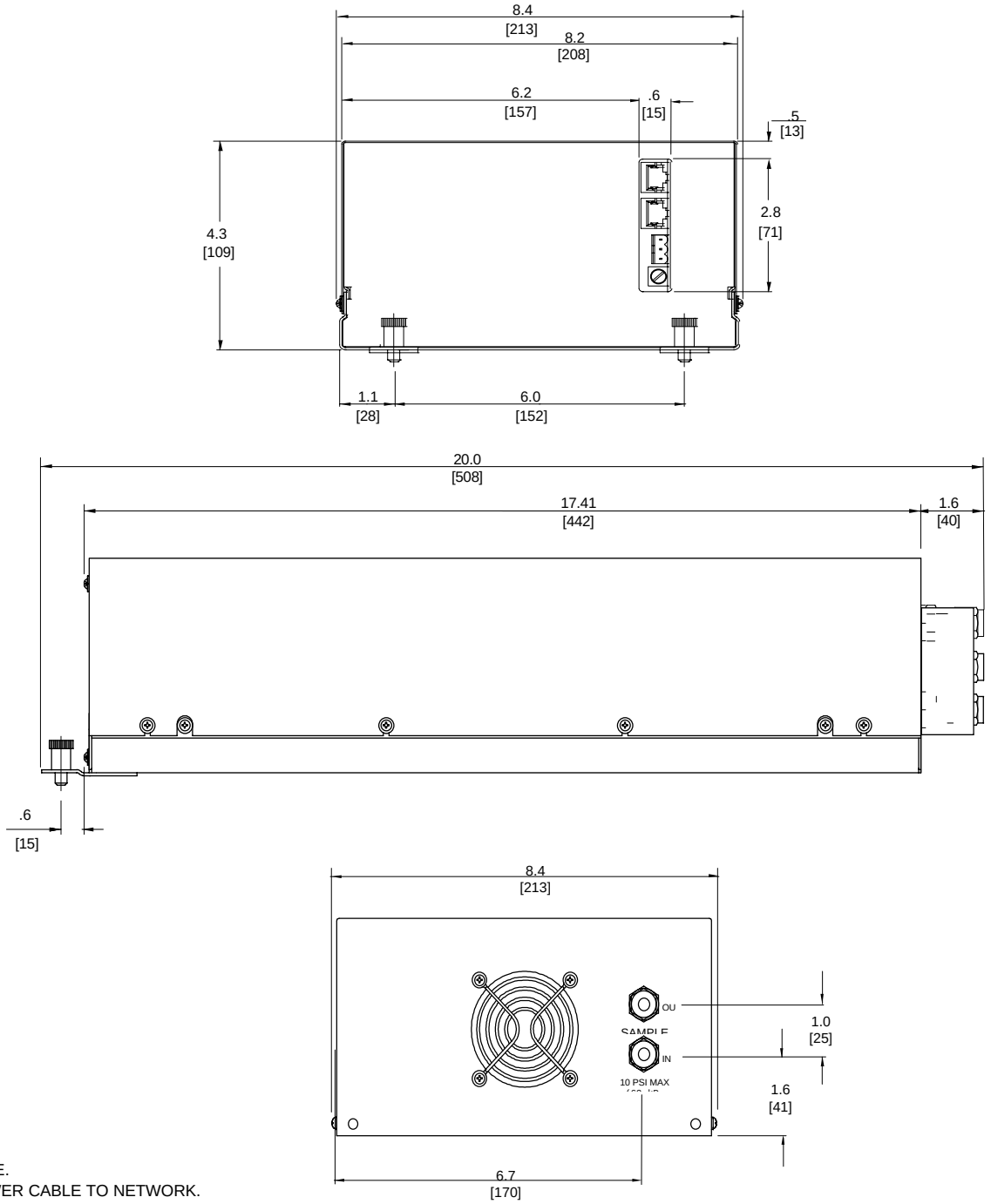


Figure 2-5. PMD Wiring Diagram



E. FUSE.
D. POWER CABLE TO NETWORK.
C. NETWORK CABLE CONNECTIONS TO PLATFORM.
B. SAMPLE OUT: 1/4" O.D. TUBE FITTING.
A. SAMPLE IN: 1/4" O.D. TUBE FITTING.

5. MODULE TO BE INSTALLED WITHIN ±15° OF HORIZONTAL.
4. POWER REQUIREMENTS: 24 VDC 3.5 A.
3. ELECTRICAL INSTALLATION MUST BE IN COMPLIANCE WITH NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) AND/OR ANY APPLICABLE NATIONAL OR LOCAL CODES.
2. MODULE IS NOT WEATHERPROOF.
1. APPROXIMATE WEIGHT: 15 LB (6.8 kg).

DIMENSIONS

INCH
[mm]

Figure 2-6. PMD Outline and Mounting Dimensions

SECTION 3
OPERATION

3-1 OVERVIEW

Prior to initial startup, the user should perform the leak test procedure outlined in Section 2-4c on page 2-3.

For the remainder of this section Analyzer Module interconnection with a Platform or some interfacing component will be assumed. Display and keypad information shall refer to that which the user can expect to see and do with regard to the front panel of the Platform.

For a complete description of the Platform front panel controls and indicators, see the Platform instruction manual, Displays & Operating Keys.

3-2 DISPLAYS

Three kinds of Display screens are available to the user:

- Run Mode
- Menu
- Help

a. Run Mode Display

The Run Mode is the normal mode of operation. In this mode, the Display (see Figure 3-1 on page 3-3) will show current gas measurement, the component of interest, the current operations of the softkeys, and a graphic bar representing the displayed concentration as ppm or as a percent of oxygen.

If more than one Analyzer Module is connected to the system, the Run Mode display will show as many as four gas measurements on screen. Alarm messages may also appear on the display (See Table 3-1 on page 3-2).

b. Menu Displays

The menu structure enables the user to access data and functions, and put information onto the network.

The Main Menu (Figure 3-2 on page 3-3) is subdivided into three levels of control based generally on which personnel is likely to use it: Basic Controls, Expert Controls and Setup, and Technical Level Configuration. See Figure 3-3 on page 3-3, Figure 3-4 on page 3-4, and Figure 3-5 on page 3-4. Many layers of the menu structure are described at appropriate places throughout this manual.

From the Run Mode display, press the MENU softkey to enter the Main Menu (Figure 3-2 on page 3-3).

c. Help Displays

The Help structure is intended to be an on-line "tutorial," context sensitive and topic-interconnected, so that the user can practically operate NGA2000 without need of an instruction manual (Figure 3-6 on page 3-4).

MESSAGE DISPLAY	DESCRIPTION	TYPE
barometer	System Barometer	warning
case temp	Case Temperature	warning
crude noise	Calculated Noise	warning
currentrnghi	Current, High Range	warning
currentrnglo	Current, Low Range	warning
det tem	Detector Temperature	warning
fan fet	Fan Current	warning
heater fet	Heater Current	warning
led current	LED Current	warning
lin error	Linearizer Error	warning
loop current	PMD Loop Current	warning
n15 volts	Power Supply, -15V	warning
p15 volts	Power Supply, +15V	warning
p24 volts	Power Supply, +24V	warning
P5 volts	Power Supply, +5v	warning
raw signal	Raw Signal	warning
Samp Pres	Sample Pressure	warning
svflow	Sample Bypass Flow	warning
bicella	PMD Photo Sensor	failure
bicellb	PMD Photo Sensor	failure
sw error	Software Error	failure

Table 3-1. PMD Analyzer Module Alarms

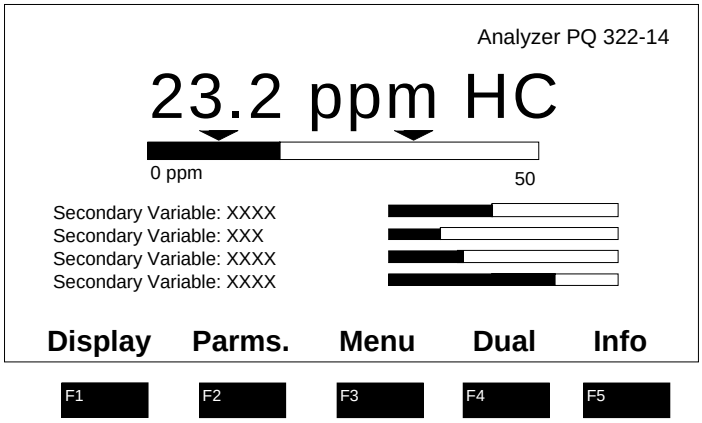


Figure 3-1. Run Mode Display

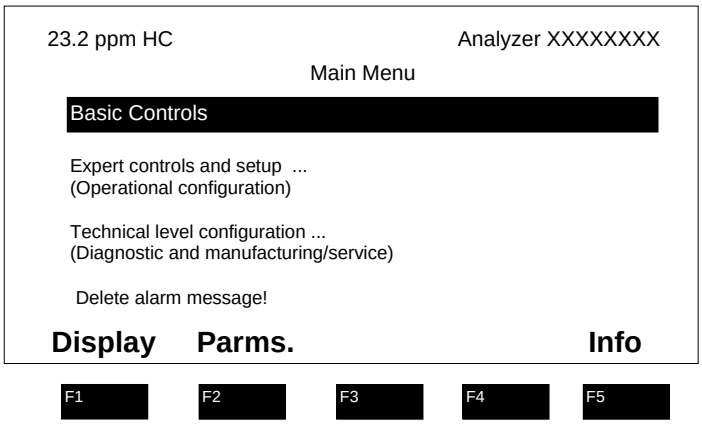


Figure 3-2. Main Menu Display

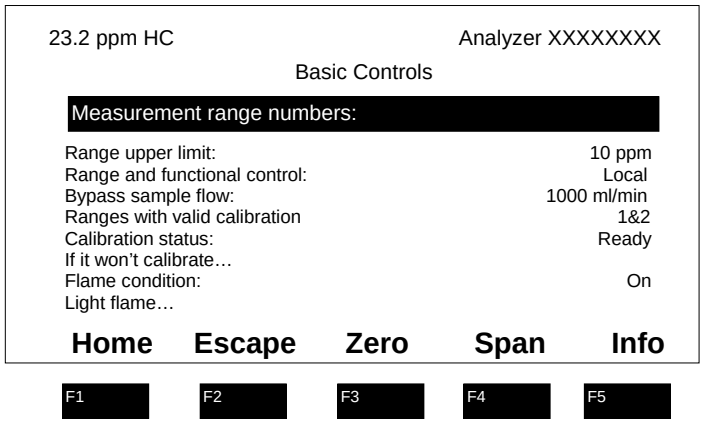


Figure 3-3. Basic Controls Menu

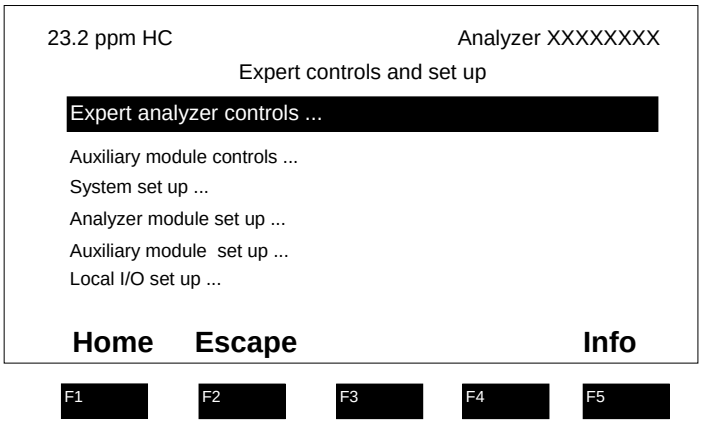


Figure 3-4. Expert Controls and Setup Menu

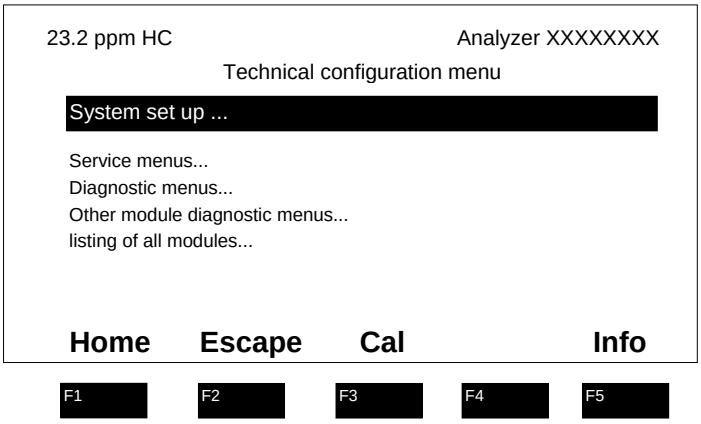


Figure 3-5. Technical Level Configuration Menu

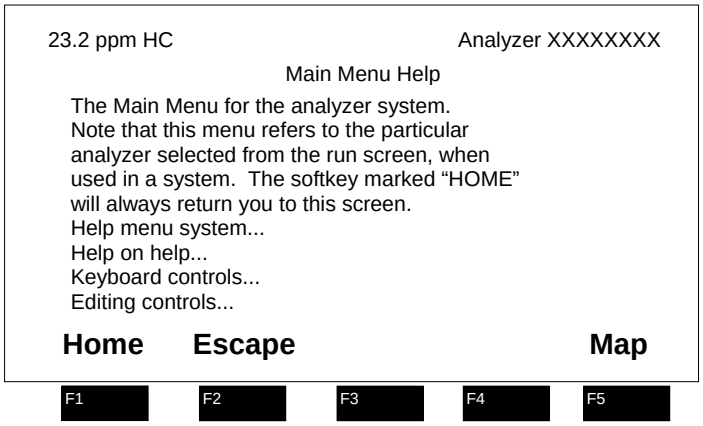


Figure 3-6. Typical Help Screen

3-3 STARTUP PROCEDURE

Introduce a suitable on-scale gas (NOT actual sample) into sample inlet.

Apply power to the PMD Analyzer Module. If it is associated with a Platform, do this by plugging in the Platform to a power source. The Platform has no ON/OFF power switch. Once power is supplied to the Platform, the PMD Analyzer Module will be energized.

If the user's system contains only one Analyzer Module, all system components, the Controller Board and the network "self-install" (bind together) during initial startup. If the system contains more than one Analyzer Module, the startup sequence will interrogate the network to locate and identify all components on the network. The user will have to bind appropriate combinations of components after the startup sequence.

After the warm-up period, approximately one hour for PMD Module, all modules are completely functional.

Enter appropriate data in the Calibration Gas List (by making the following display selections: Main Menu, Expert Controls and Setup [enter security code, if necessary], Analyzer Module setup, Calibration Gas List). Also, enter appropriate values in the Calibration Parameters menu (by making the following display selections: Main Menu, Expert Controls and Setup [enter security code, if necessary], Analyzer Module Setup, Calibration Parameters), particularly data related to which ranges are to be zeroed together and how the Analyzer Module is expected to calibrate ranges (separately or otherwise).

The Analyzer Module will not allow the user to increase the upper limit of a range beyond the "maximum range" software setting. To change the "maximum range" value, select the following from the Main Menu: Technical Configuration Menu, Service Menu, Manufacturing Data, Analyzer Module Data. Select Maximum Range, and use the arrow keys to scroll the indicated value. The same applies for "minimum range" settings.

3-4 BINDING

To achieve full coordination between Analyzer Modules and associated I/O Modules, the user must bind those components together in the System Setup portion of the Technical Configuration Menu in software.

3-5 CALIBRATION

Calibration consists of establishing zero and span calibration points. Generally, zero and span calibration should be performed on the range that will be used during sample analysis.

To calibrate the PMD Analyzer Module, introduce zero gas into the SAMPLE INLET, and do the following:

1. If the *Multi-Analyzer Module*, split *Run Mode* display is shown, press the *DISPLAY* softkey until the desired Analyzer's *Run Mode* display is acquired.

2. Press the *MENUS* softkey to enter the *Main Menu*.

3. Press the *ENTER* key to enter the *Basic Controls menu*.

4. Press the *ZERO* softkey to enter the *Analyzer Zero menu*.

5. Press the *ZERO* softkey and wait.

6. Introduce span gas (Table 3-2 on page 3-6) into the SAMPLE INLET.

7. Press the *SPAN* softkey to enter the *Analyzer Span menu*, press *SPAN* again and wait.

8. Press the *HOME* softkey to re-enter the *Main Menu*.

9. Press the *DISPLAY* softkey for the *Run Mode* display.

For users of analyzers with suppressed indicating ranges, it may be desireable to calibrate the analyzer zero and span points within the suppressed range with gases in the sup-

pressed range. Table 3-3 below shows recommended zero and span standard gases for suppressed range oxygen indication in an Argon background.

RANGE % OXYGEN	RECOMMENDED ZERO STANDARD GAS	RECOMMENDED SPAN STANDARD GAS
0 to 1	Nitrogen	0.9% O_2, balance N_2
0 to 2.5	Nitrogen	2.3% O_2, balance N_2
0 to 5	Nitrogen	4.5% O_2, balance N_2
0 to 10	Nitrogen	9% O_2, balance N_2
0 to 25	Nitrogen	Air (20.93% O_2)
0 to 50	Nitrogen	45% O_2, balance N_2
0 to 100	Nitrogen	100% O_2

Table 3-2. Calibration Range for Various Zero Based Operating Ranges

RANGE % OXYGEN	RECOMMENDED ZERO STANDARD GAS	RECOMMENDED SPAN STANDARD GAS
50 to 100	50 - 50.5% O_2 Balance AR	100% O_2
70 – 100%	70 – 70.5% O_2 Balance AR	100% O_2
98 – 100%	98 – 98.5% O_2 Balance AR	100% O_2
99 – 100%	99 – 99.5% O_2 Balance AR	100% O_2

Table 3-3. Calibration Range for Various Suppressed Range Operations

If the user is unable to calibrate the Analyzer Module (i.e., when ZERO or SPAN is initiated, nothing happens), a possible solution relates to the use of an incorrect gas for zeroing or spanning (e.g., using a high concentration gas to zero or a zero gas to span the Analyzer Module). Recalibrating with the appropriate gas(es) WILL NOT correct the problem because the ZERO OFFSET or SPAN FACTOR has been set to an extreme value in the process.

To remedy the problem, do the following:

1. Select the following from the Main Menu: Expert Controls and Setup (enter security code if necessary), Analyzer Module Setup, and Calibration Parameters.

2. Using the down arrow, select Zero Ranges, press ENTER and, using the up/down arrows, toggle to SEPARATE. Do the same for the Span Ranges selection. Do not press ESCAPE at any time unless retention of prior settings is desired.

3. Return to the Main Menu (HOME) and make the following selections: Expert Controls and Setup (enter security code if necessary), Expert Analyzer Controls, CAL softkey, FACTORS softkey, and

Range 1 (2, 3, 4) Factors. (Do steps 4 and 5 for each range.)

4. Select Zero Offset, press ENTER, adjust the value to 525000 with the up/down arrow keys, and press ENTER. Do not press ESCAPE at any time unless retention of prior settings is desired.

5. Select Span Factor, press ENTER, adjust the value to 0.000015 with the up/down arrow keys, and press ENTER. Do not press ESCAPE unless retention of prior settings is desired.

6. Attempt to recalibrate the Analyzer Module according to the procedure outlined at the beginning of Section 3-5 on page 3-5. If re-calibration fails, return to the Range Factors menu, readjust factors, and attempt calibration again.

3-6 BACKGROUND GAS COMPENSATION

Any gas having a composition other than 100% oxygen contains background gas, that is, non-oxygen components. Sometimes, the PMD Module response to background gas is significant, depending largely on the span and range used.

If the operator uses zero and span gases that contain the same background gas as the sample, calibration procedures automatically compensate. No adjustments are necessary.

If the background gas in the sample is different from that in the zero and/or span gases, the operator must take into consideration background effects to ensure correct readout. During entry of zero and span gas values in the Calibration Gas List, the instrument is not set to indicate the true oxygen content of the zero and span standard gases. It is set to indicate a slightly different value, relative to background gas, calculated to provide correct readout during subsequent analysis of sample gas.

Oxygen Equivalent Values of Gases

For computation of background corrections, the analyzer's response to each component of the sample must be known. Table 3-4 on page 3-10 lists the percentage oxygen equivalent values for many common gases. For a more comprehensive list of oxygen equivalent values, refer to a resource text such as the Handbook of Chemistry and Physics for tables of magnetic susceptibility of substances. The percentage oxygen equivalent of a gas can be determined by the following equation, assuming both gases are supplied at the same pressure:

$$\%O2 \text{ Equivalent of Gas} = \frac{\text{Analyzer Response to Gas}}{\text{Analyzer Response to O2}} \times 100\%$$

For example, if the analyzer's response to oxygen is +100%, the response to xenon would be -1.34%.

The oxygen equivalent of a gas mixture is the sum of the contribution of the individual gas components.

Example: Zero Based Range

At lower range limit (i.e., 0% O_2), composition of sample is: 80% CO_2, 20% N_2.

From Table 3-4 on page 3-10, the percent oxygen equivalents are: CO_2 -0.623%, N_2 -0.358%.

The percent oxygen equivalent of the mixture = 0.8(-0.623) + 0.2(-0.358) = (-0.4984) + (-0.0716) = 0.570% O_2.

Computing Adjusted Values for Calibration Gas List

Before calibrating the Analyzer Module, values in the Calibration Gas List must be adjusted to correct for magnetic susceptibility of background gas. In the equation that follows, the quantities are defined as follows:

- **BGGst** = oxygen equivalent of background gas in standard gas (Table 3-4 on page 3-10).
- **BGGs** = oxygen equivalent of background gas in sample (Table 3-4 on page 3-10).
- **OP** = operating pressure. Unless special pressure corrections are to be made, the zero standard, span standard and sample gases must all be admitted at the same pressure.

Use the following equation to compute the adjusted settings for the Calibration Gas List:

$$\text{Adjusted percent oxygen for standard gas} = \frac{(A)[100 + (B-C)]-100[B-C]}{100}$$

Where:

A = true percent oxygen of standard gas

B = BGGs

C = BGGst

Example:

Background gs in sample is CO_2, oxygen equivalent = -0.623%.

Zero gas is 100% N_2.

Span standard gas is air: 21% O_2, 79% N_2.

Background gas in zero and span standard gases is N_2, oxygen equivalent = 0.358%.

With N_2 zero standard gas flowing, zero gas value in the Calibration Gas List would be 0.265% O_2 (as determined by the following):

$$\frac{0[100+(-0.623-(-0.358))] - 100\{-0.623-(-0.358)]}{100} = 0.265\%\ O_2$$

With air flowing, span gas value in the Calibration Gas List would be 21.21% oxygen (as determined by the following):

$$\frac{21(100 - 0.265) - 100\ (-0.265)}{100} = 21.209\%\ O_2 \cong\ 21.21\ O_2$$

In two limiting cases, the general equation is reduced to simpler forms.

1. If the span standard gas is 100% oxygen, the adjusted oxygen value is the same as the true value (i.e., 100% O_2).

2. If the zero standard is an oxygen-free zero gas, the adjusted value for setting the ZERO Control = BGGst-BGGs. (If the oxygen-free zero gas is more diamagnetic than the background gas in the sample, this difference is negative. The negative value may be entered in the Calibration Gas List.)

Alternately, the user can avoid these compensation calculations by using zero and span gases which have been specially prepared to contain the expected amounts of background gas. Calibration of the analyzer module will then factor in background gas effects in the same proportions as normal run mode measurement.

GAS	EQUIV. % AS O_2
Acetylene, C_2H_2	-0.612
Allene, C_3H_4	-0.744
Ammonia, NH_3	-0.479
Argon, A	-0.569
Bromine, Br2	-0.83
1,2-Butadiene, C_4H_6	-1.047
1,3-Butadiene, C_4H_6	-0.944
n-Butane, C_4H_{10}	-1.481
iso-Butane, C_4H_{10}	-1.485
Butene-1, C_4H_8	-1.205
cis Butene-2, C_4H_8	-1.201
iso-Butene, C_4H_8	-1.274
trans Butene-2, C_4H_8	-1.274
Carbon Dioxide, CO_2	-0.623
Carbon Monoxide, CO	-0.354
Ethane, C_2H_6	-0.789
Ethylene, C_2H_4	-0.553
Helium, He	-0.059
n-Heptane, C_7H_{16}	-2.508
n-Hexane, C_6H_{14}	-2.175
cyclo-Hexane, C_6H_{12}	-1.915
Hydrogen, H_2	-0.117

GAS	EQUIV. % AS O_2
Hydrogen Bromide, Hbr	-0.968
Hydrogen Chloride, HC1	-0.650
Hydrogen Fluoride, HF	-0.253
Hydrogen Iodide, HI	-1.403
Hydrogen Sulhide, H_2S	-0.751
Krypton, Kr	-0.853
Methane, CH_4	-0.512
Neon, Ne	-0.205
Nitric Oxide, NO	+44.2
Nitrogen, N_2	-0.358
Nitrogen Dioxide, NO_2	+28.7
Nitrous Oxide, N_2O	-0.560
n-Octane, C_8H_{18}	-2.840
Oxygen, O_2	+100.0
n-Pentane, C_5H_{12}	-1.810
iso-Pentane, C_5H_{12}	-1.853
neo-Pentane, C_5H_{12}	-1.853
Propane, C_3H_8	-1.135
Propylene, C_3H_6	-0.903
Water, H_2O	-0.381
Xenon, Xe	-0.340

Table 3-4. Oxygen Equivalents of Common Gases

3-7 BAROMETRIC PRESSURE COMPENSATION

Although normally calibrated for readout in percent oxygen, the PMD Analyzer Module actually responds to oxygen partial pressure. The partial pressure of the oxygen component in a gas mixture is proportional to the total pressure of the mixture. Thus readout is affected by pressure variations.

For instance, assume that an instrument is calibrated for correct readout with a standard gas containing 5% oxygen, admitted at the normal sea level atmospheric pressure of 14.7 psia (1013 hPa). If the operating pressure now drops to one-half of the original value (i.e., to 7.35 psia/506 hPa and the calibration controls are left at the previously established settings, the display reading for the standard gas will drop to 2.5%.

It is therefore necessary to calibrate the instrument at the same pressure that will be used during subsequent operation, and to maintain this pressure during operation.

Alternatively, an optional Barometric Pressure Compensation Board, typically used for suppressed range applications, can perform signal corrections automatically.

SECTION 4
MAINTENANCE AND SERVICE

WARNING

QUALIFIED PERSONNEL

This equipment should not be adjusted or repaired by anyone except properly qualified service personnel.

4-1 OVERVIEW

PMD Analyzer components that may require replacement include:

- All printed circuit board
- Thermal fuse inside Detector
- Case temperature sensor
- Flow sensor
- Power fuse
- Detector
- Module fan

The LED bi-cell assembly source required adjustment (rotation) anytime the Detector is disassembled. Refer to Figure 4-3 on page 4-3 for locations of these components.

4-2 PRINTED CIRCUIT BOARD REPLACEMENT

Refer to Figure 4-1 belowfor locations of the Signal, Microprocessor, Power Supply and (optional) Pressure Compensation Boards.

All boards are secured to a side of the analyzer module that folds out while interconnection wiring is still in place. Remove the securing screws and fold out the entire panel.

To remove individual boards on the fold-out panel, label and unplug all interconnection wiring, and remove securing hardware. Reverse this procedure for installation.

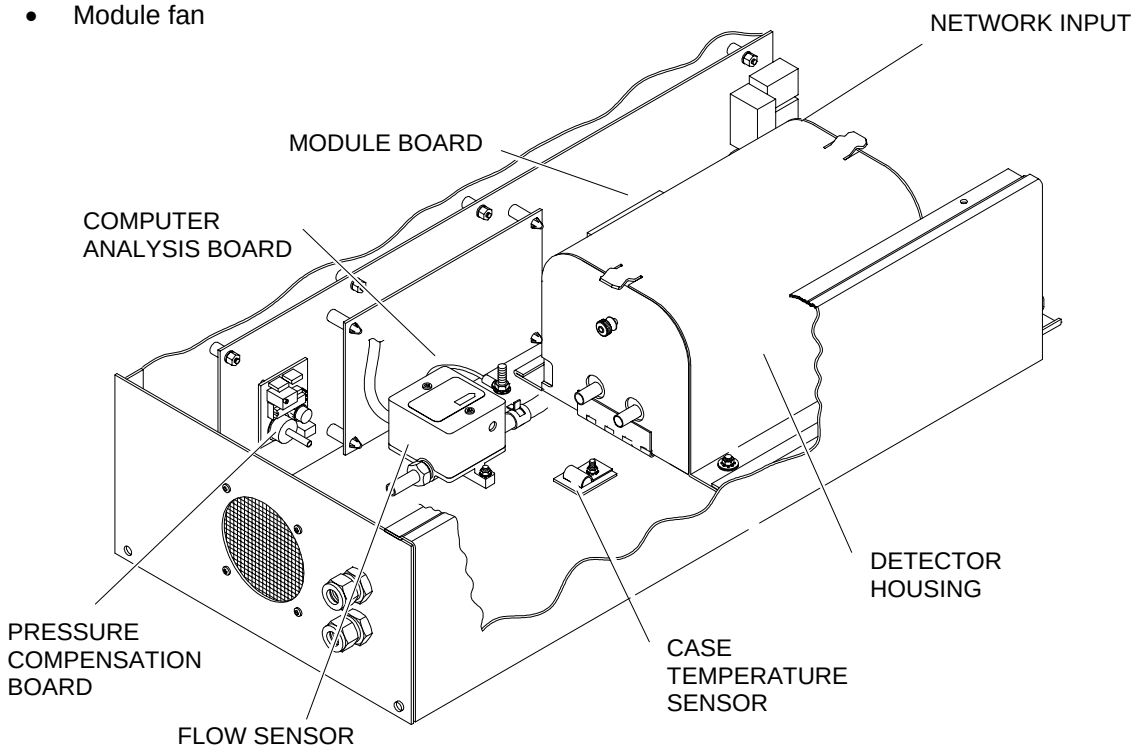


Figure 4-1. PMD Module – Major Components

4-3 MODULE FAN REPLACEMENT

The Analyzer Module fan assembly is disassembled as shown in Figure 4-2 below.

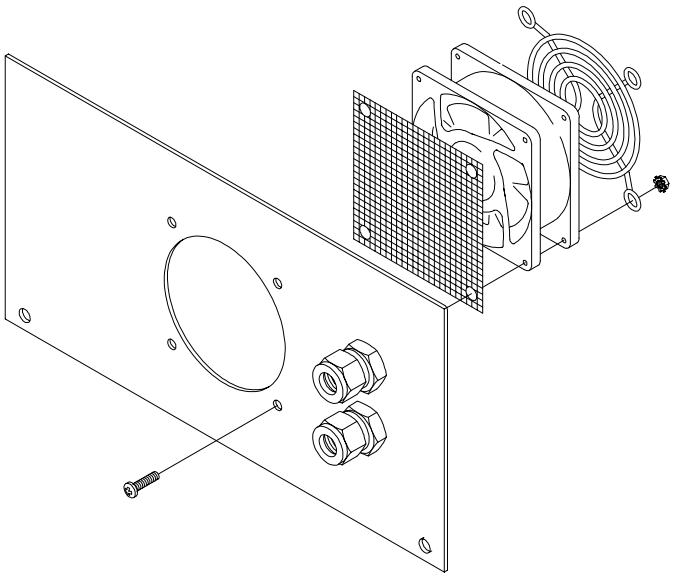


Figure 4-2. Module Fan Assembly

4-4 THERMAL FUSE REPLACEMENT

See Figure 4-3 below for location of the Detector Thermal Fuse.

Remove the Detector Assembly form the detector housing, replace the thermal fuse.

Reassemble in reverse order.

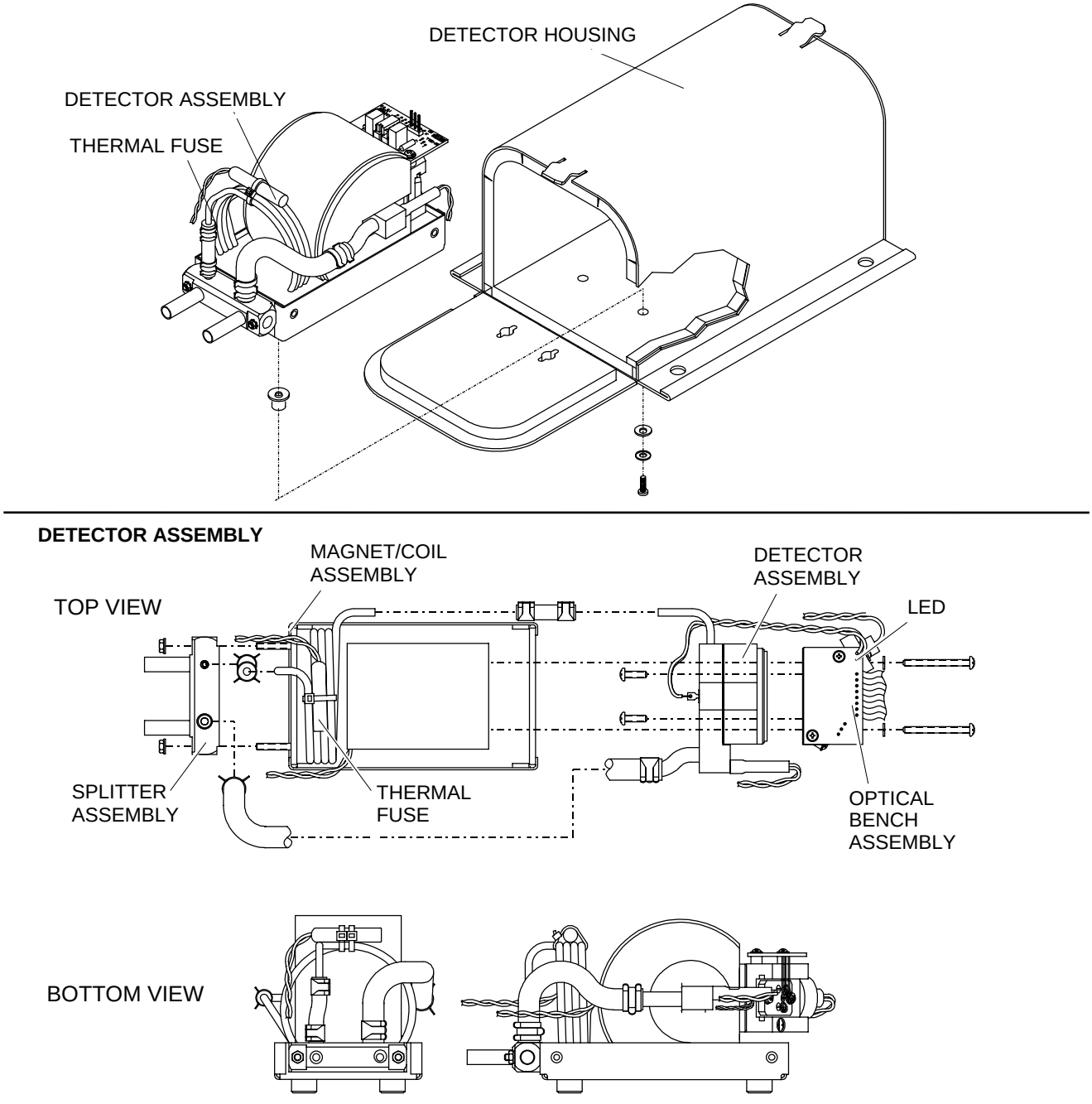


Figure 4-3. Detector Assembly

4-5 FLOW SENSOR REPLACEMENT

See Figure 4-1 on page 4-1 for location of Flow Sensor. To replace the sensor, remove connections to sample gas line and disconnect securing hardware. Reassemble in reverse order.

4-6 POWER FUSE REPLACEMENT

The power fuse is located in the Network Input Module and is accessible through the front panel of the PMD Analyzer. To remove the fuse, push and turn the fuseholder cap 1/4 turn counterclockwise. Verify that the replacement fuse is the same type and rating.

SECTION 5
REPLACEMENT PARTS

WARNING

PARTS INTEGRITY

Tampering with or unauthorized substitution of components may adversely affect safety of this product. Use only factory-approved components for repair.

5-1 MATRIX

Each analyzer is configured per the customer sales order. Below is the PMD sales matrix which lists the various configurations available.

To identify the configuration of an analyzer, locate the analyzer name-rating plate. The sales matrix identifier number appears on the analyzer name-rating plate.

PMD2	NGA2000 PARAMAGNETIC DETECTOR

Code	Software Version
01	Current Version
02	2.2.1 version
03	3X version – specify version

Code	Configuration Identifier
A1	Calibrated Standard Ranges: 0-5, 0-10, 0-25, 0-100%
A2	Calibrated Standard Ranges: 0-1, 0-5, 0-10, 0-25%
H1	Calibrated Standard Suppressed Ranges/Barometric Pressure Compensation: 90-100, 95-100, 98-100, 99-100%
H2	Calibrated Standard Suppressed Ranges/Barometric Pressure Compensation: 50-100, 70-100, 80-100, 90-100%
99	Special Calibration Ranges

Code	Barometric Pressure Compensation
00	None
S1	Standard Elevations
E1	High Elevations

Code	Detector Type
R1	Rhodium Plated Current Loop
T1	Titanium Current Loop (Standard)

PMD2	01	A1	S1	T1	Example

5-2 REPLACEMENT PARTS

902931	Sensor, Gas Flow
655856	Source/Holder Assembly
902922	Bi-Cell, Optical
655670	Pressure Compensation Board
903347	Fuse, Time-Delay 6A 250 VAC
657860	Module Board
622917	Sensor RTD
656576	Case Temperature Sensor
655893	Fan
898733	Detector Thermal Fuse
655838	Optical Bench Assembly
658083	Detector, Corrosion Resistant (Option)

SECTION 6
RETURN OF MATERIAL

6-1 RETURN OF MATERIAL

If factory repair of defective equipment is required, proceed as follows:

1. Secure a return authorization from a Rosemount Analytical Inc. Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.

   Rosemount CSC will provide the shipping address for your instrument.

   In no event will Rosemount be responsible for equipment returned without proper authorization and identification.
2. Carefully pack the defective unit in a sturdy box with sufficient shock absorbing material to ensure no additional damage occurs during shipping.
3. In a cover letter, describe completely:
   - The symptoms that determined the equipment is faulty.
   - The environment in which the equipment was operating (housing, weather, vibration, dust, etc.).
   - Site from where the equipment was removed.
   - Whether warranty or non-warranty service is expected.
   - Complete shipping instructions for the return of the equipment.
4. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in the Rosemount Return Authorization, prepaid, to the address provided by Rosemount CSC.

Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

If warranty service is expected, the defective unit will be carefully inspected and tested at the factory. If the failure was due to the conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with the shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

6-2 CUSTOMER SERVICE

For order administration, replacement Parts, application assistance, on-site or factory repair, service or maintenance contract information, contact:

Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

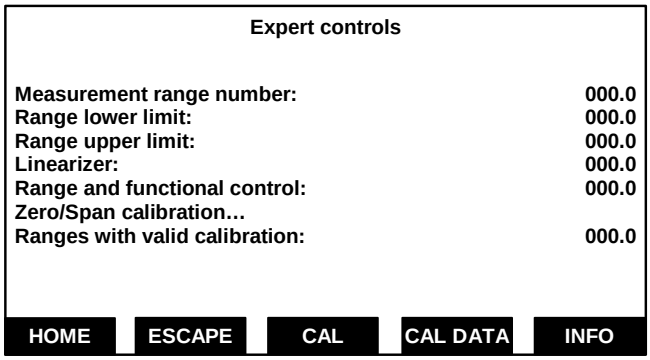
6-3 TRAINING

A comprehensive Factory Training Program of operator and service classes is available. For a copy of the *Current Operator and Service Training Schedule* contact the Technical Services Department at:

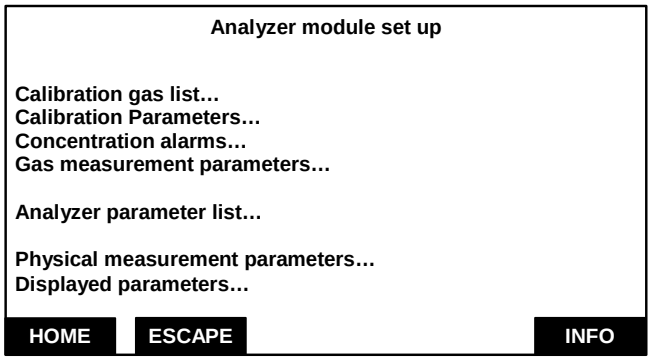
Rosemount Analytical Inc.
Customer Service Center
1-800-433-6076

SECTION 7
APPENDIX A. MENU DISPLAYS

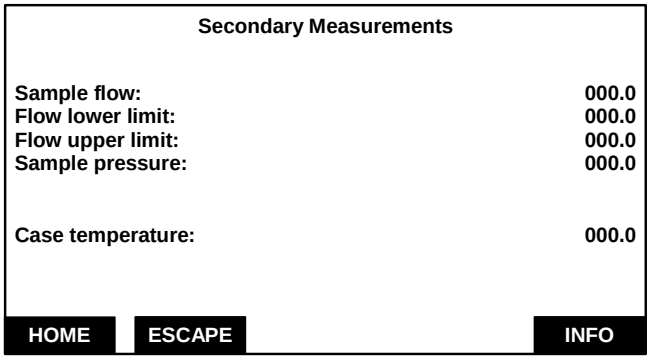
Menu: 0 ANALOP



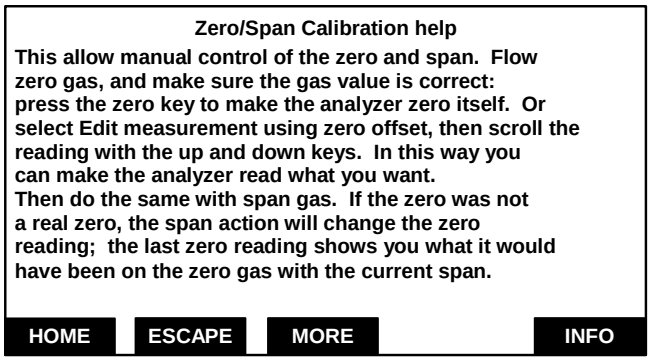
Menu: 1 ANALSET



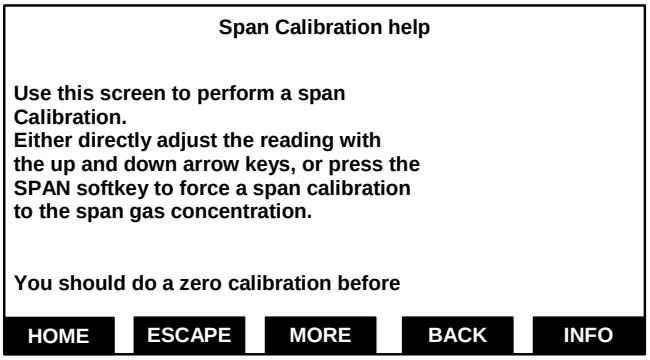
Menu: 2 FLOCHEK



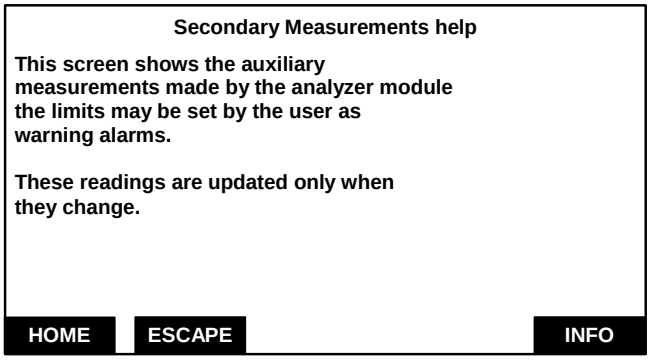
Menu: 3 ZEROl1



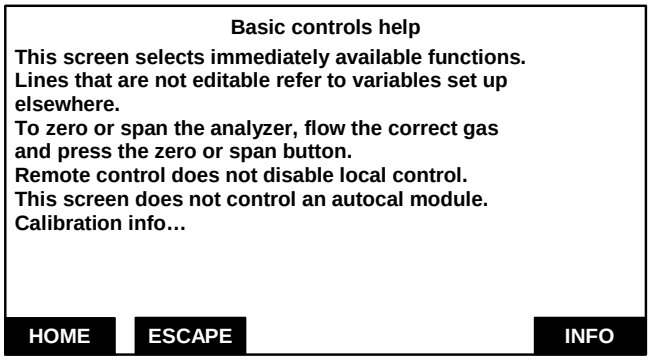
Menu: 4 SPANl1



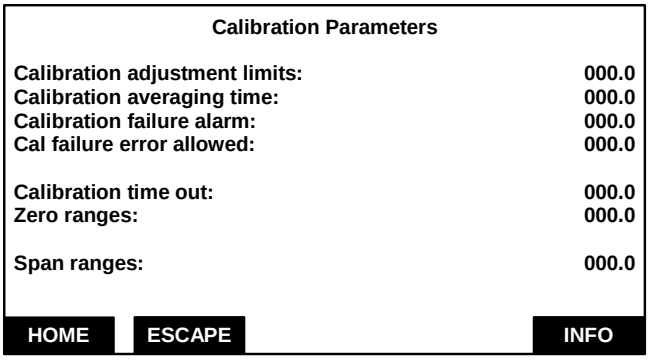
Menu: 5 FLOCHEKl1



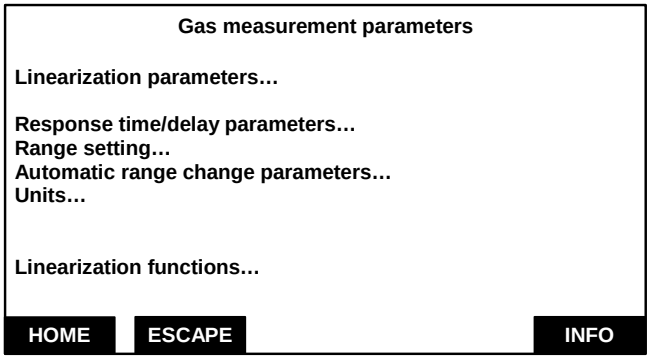
Menu: 6 ANALOPl1



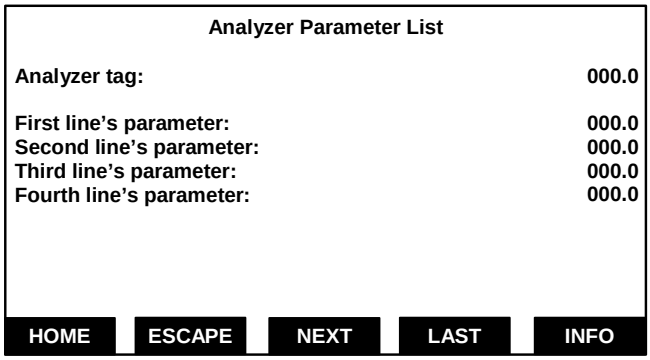
Menu: 7 ACALSET



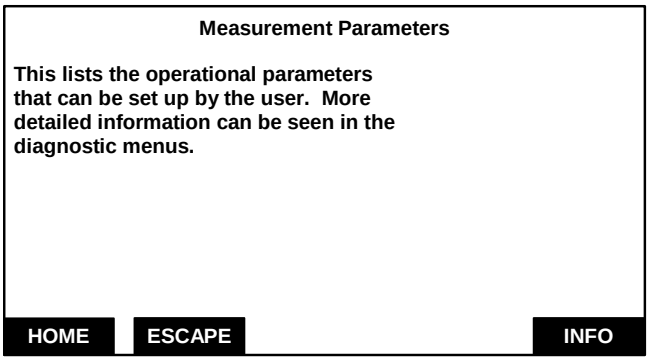
Menu: 8 LINSET



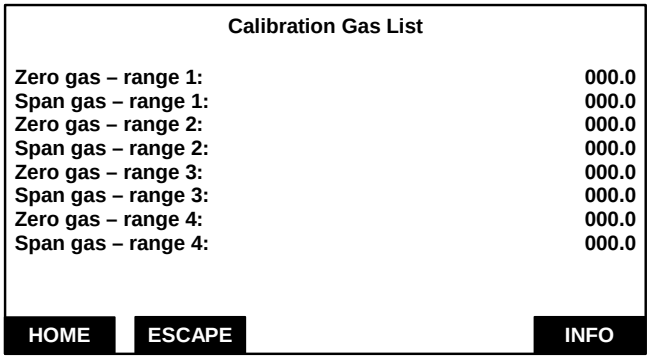
Menu: 9 APARLST



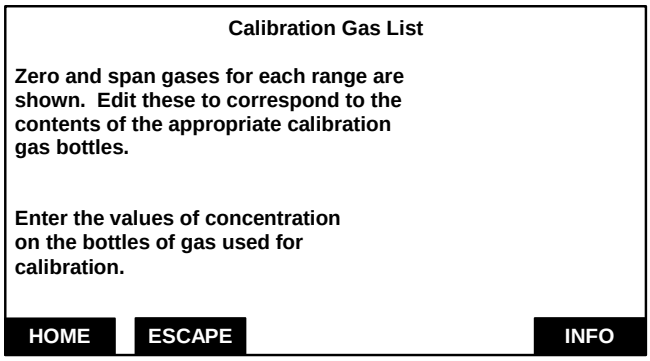
Menu: 10 ANALSETI1



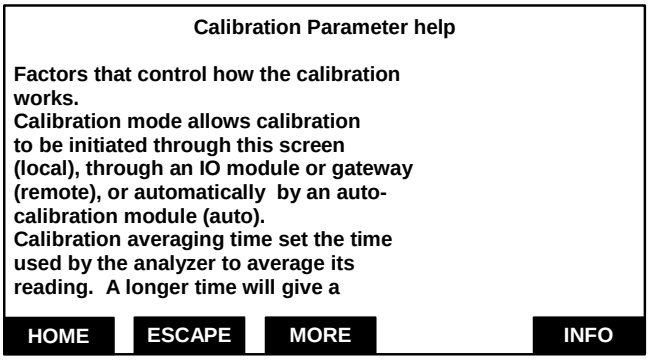
Menu: 11 CALLIST



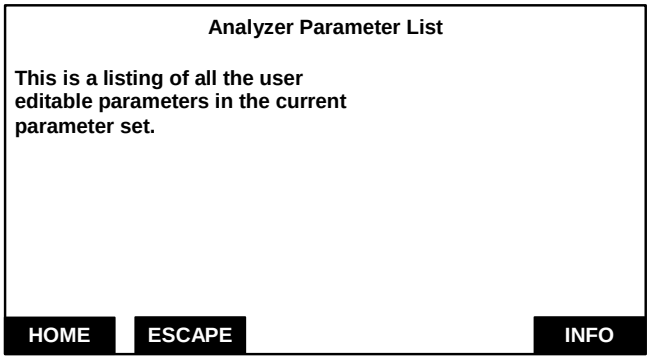
Menu: 12 CALLISTl1



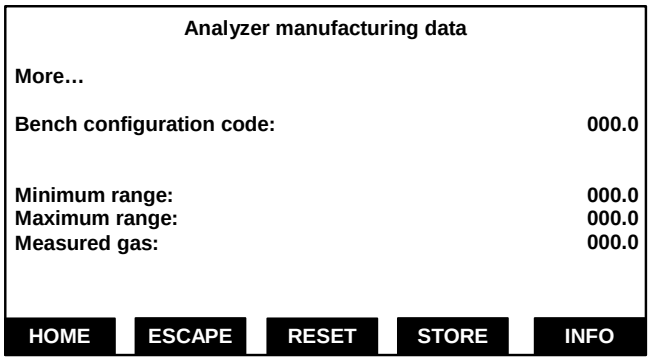
Menu: 13 ACALSETl1



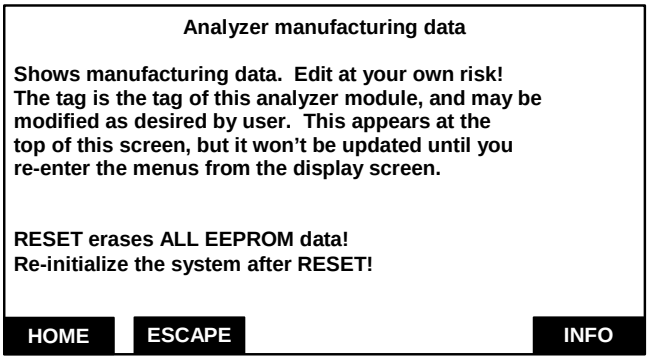
Menu: 14 APARLSTl1



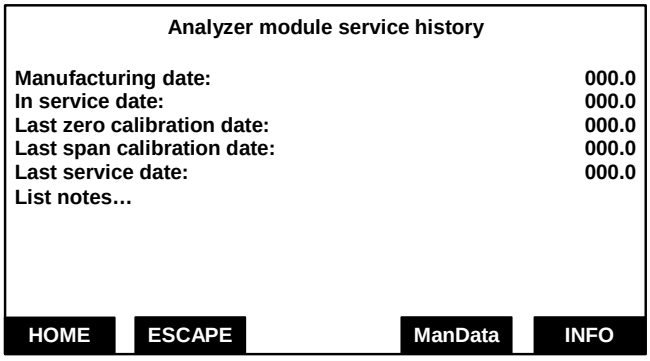
Menu: 15 AMMAN



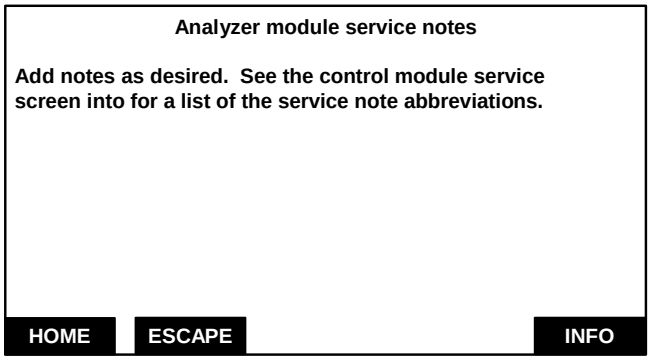
Menu: 16 AMMANl1



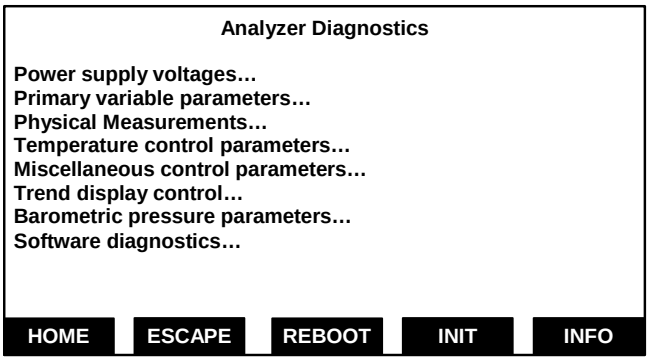
Menu: 17 AMSVC



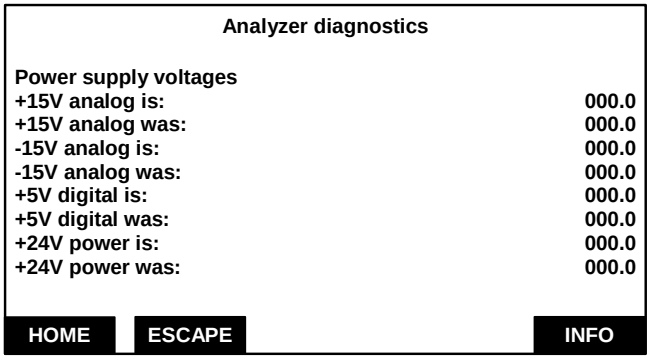
Menu: 18 AMSVCl1



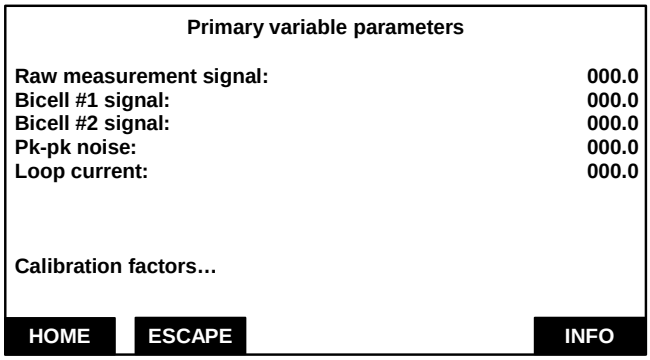
Menu: 19 ADIAG



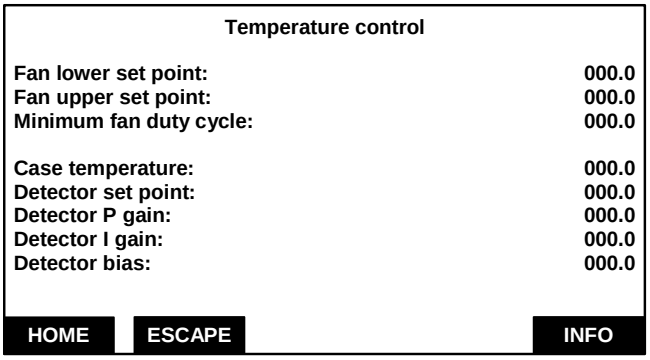
Menu: 20 AMPWR



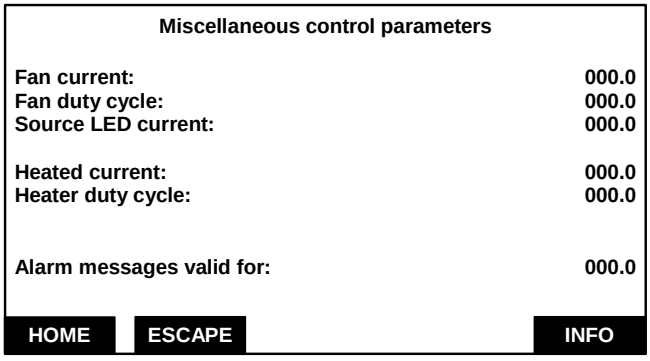
Menu: 21 AM1V



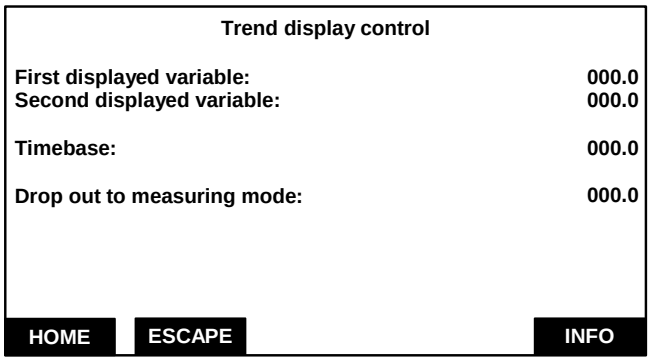
Menu: 22 AMTEMP



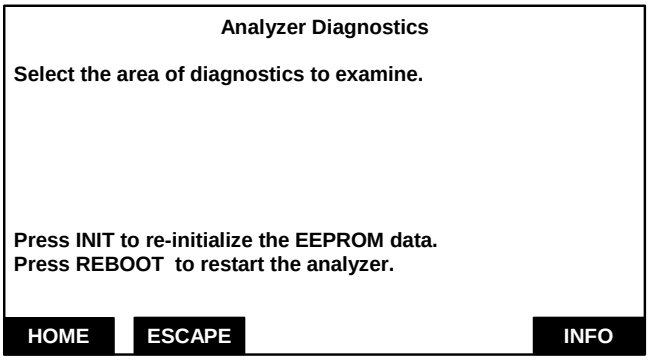
Menu: 23 AMMISC



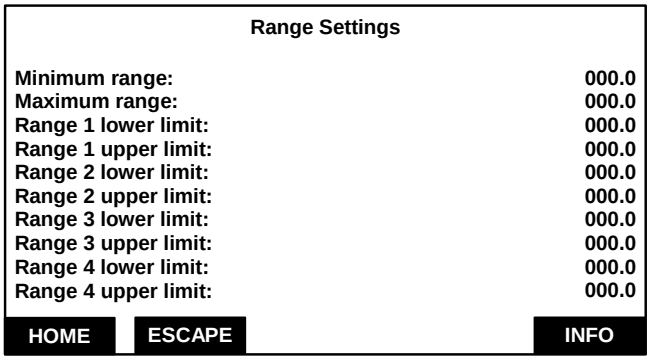
Menu: 24 AMTREND



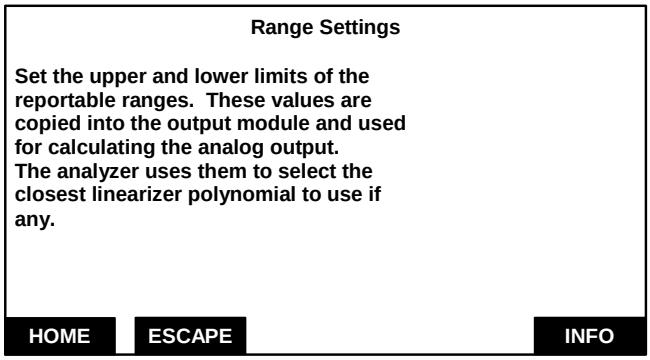
Menu: 25 ADIAGl1



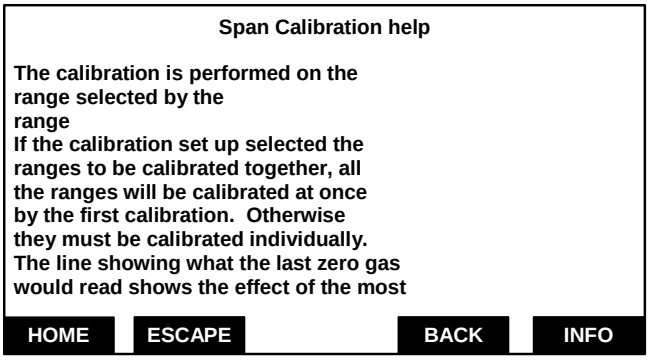
Menu: 26 RANGESETAM



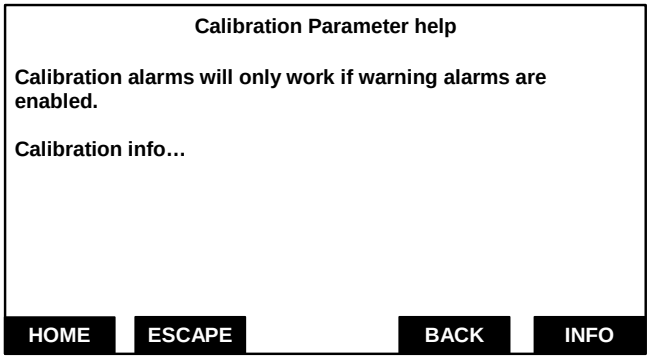
Menu: 27 RANGESSETl1



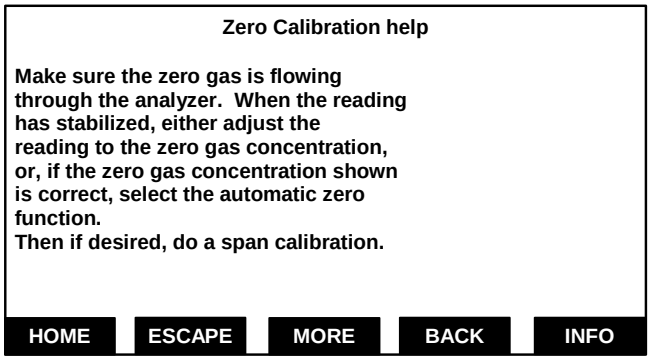
Menu: 28 SPANl2



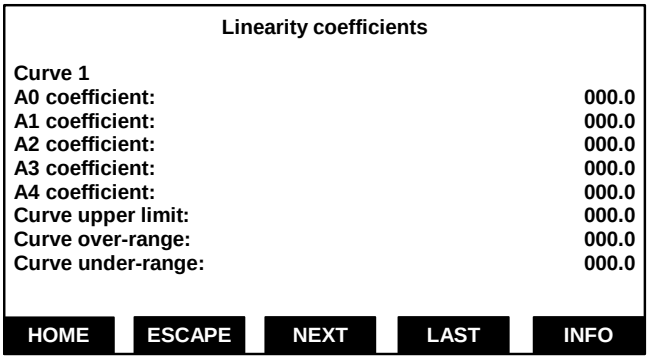
Menu: 29 ACALSETl2



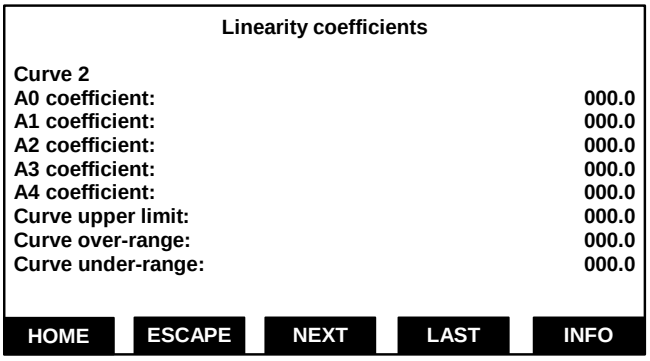
Menu: 30 ZEROl2



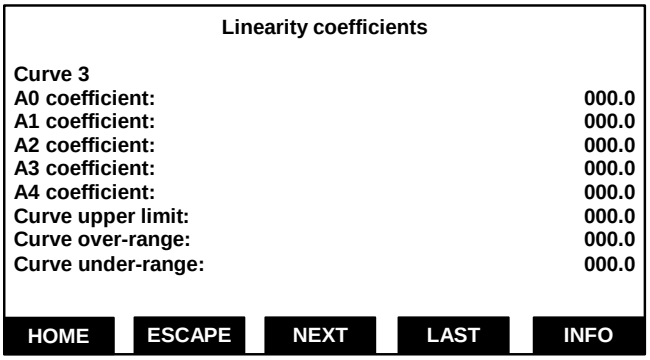
Menu: 31 LINRANGE1



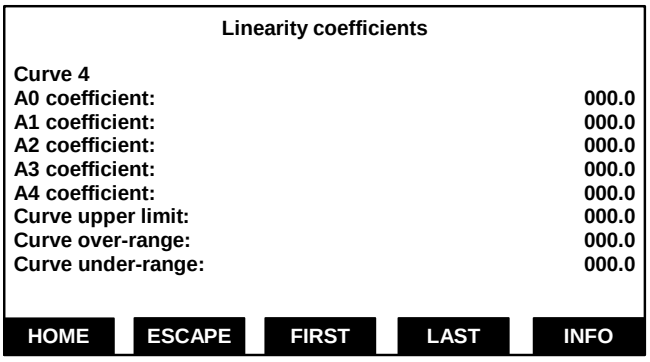
Menu: 32 LINRANGE2



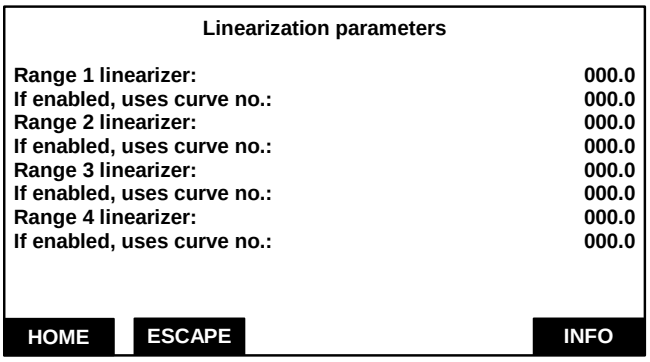
Menu: 33 LINRANGE3



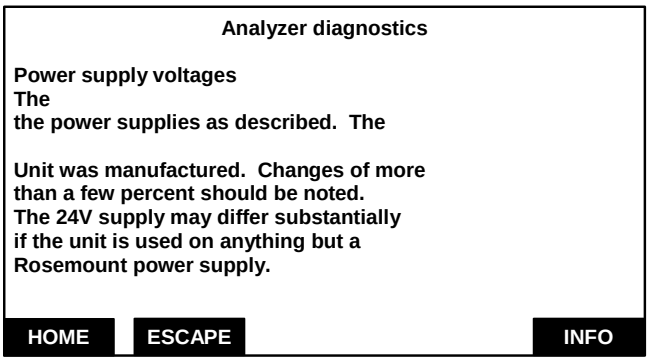
Menu: 34 LINRANGE4



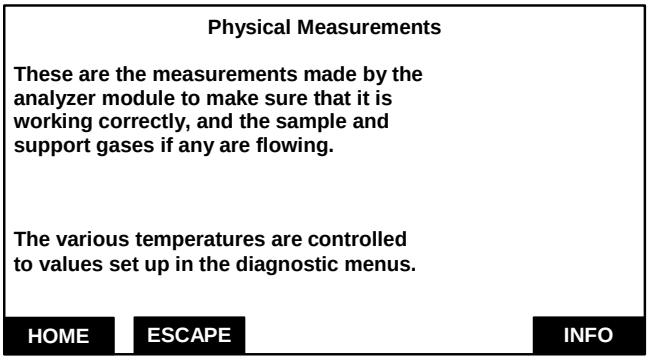
Menu: 35 LINRANGE0



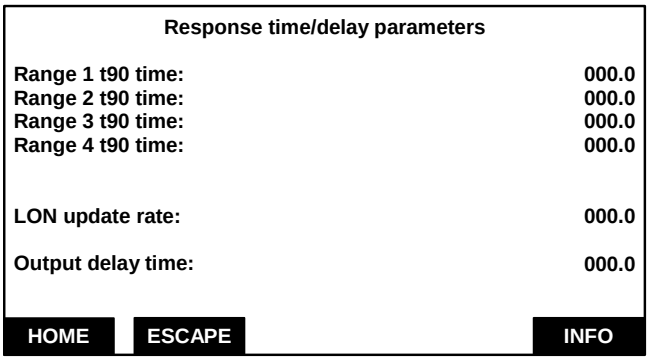
Menu: 36 AMPWRl1



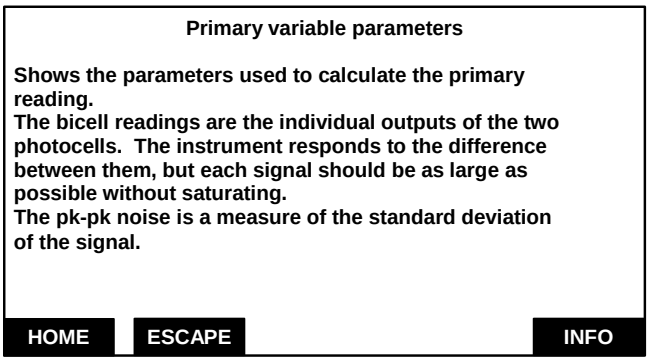
Menu: 37 FLOCHEK1l1



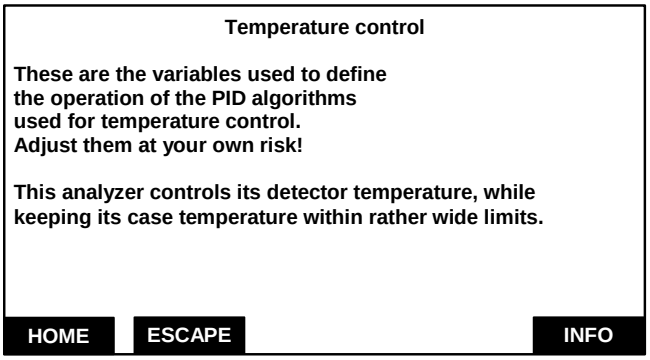
Menu: 38 FILTER



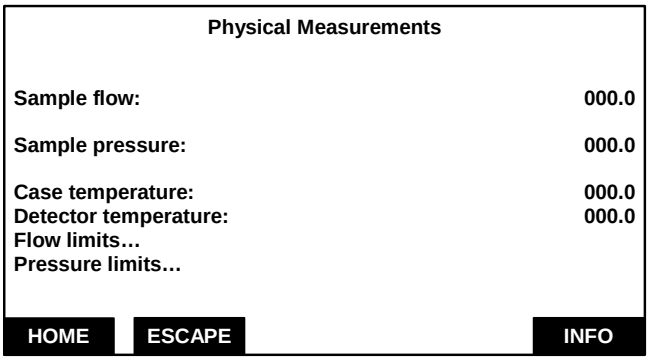
Menu: 39 AM1Vl1



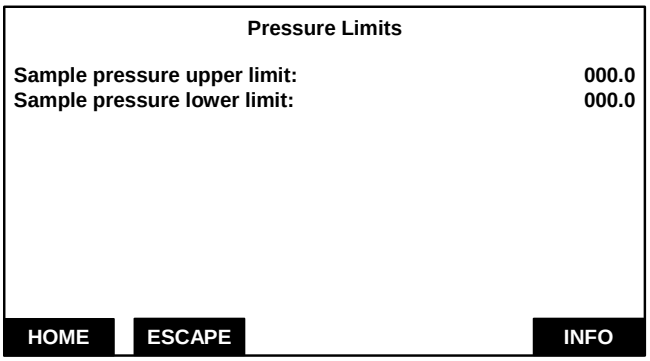
Menu: 40 AMTEMPl1



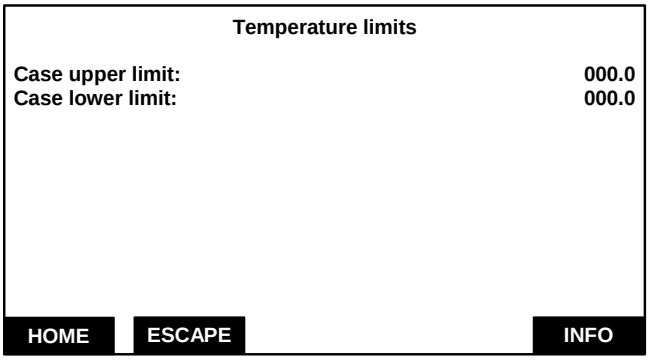
Menu: 41 AM2VA



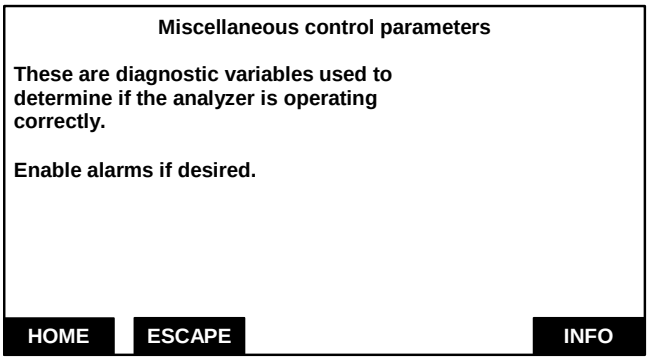
Menu: 42 PLMITSA



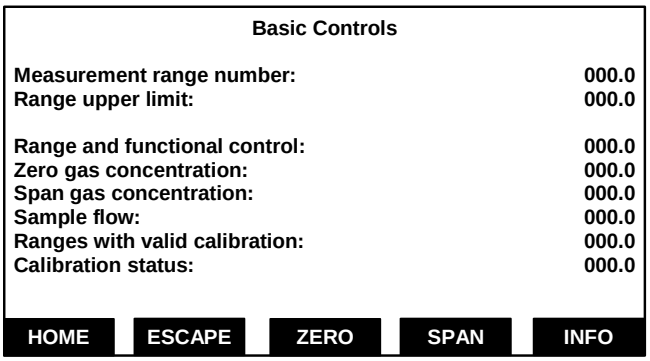
Menu: 43 TLIMITSA



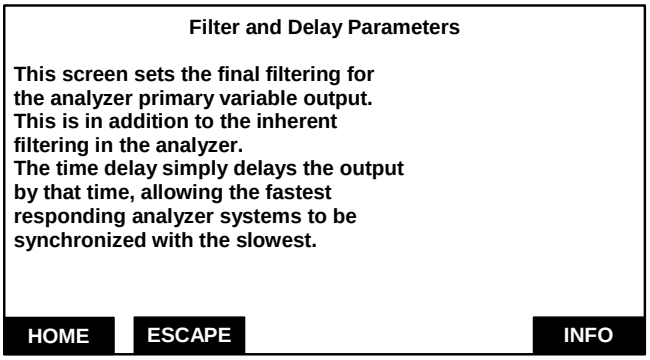
Menu: 44 AMMISCl1



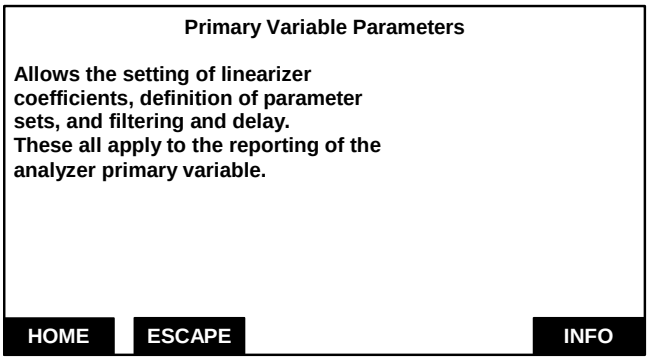
Menu: 45 ANALSIMPLE



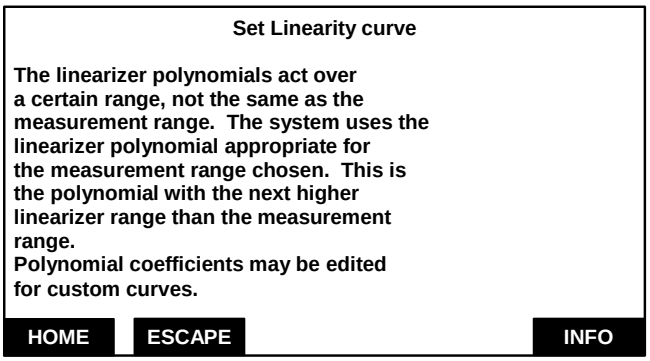
Menu: 46 FILTERl1



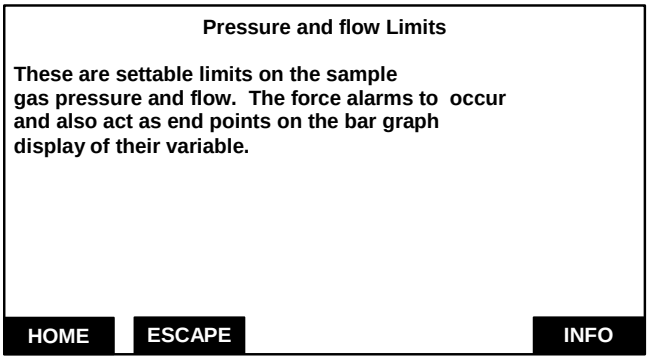
Menu: 47 LINSET1l1



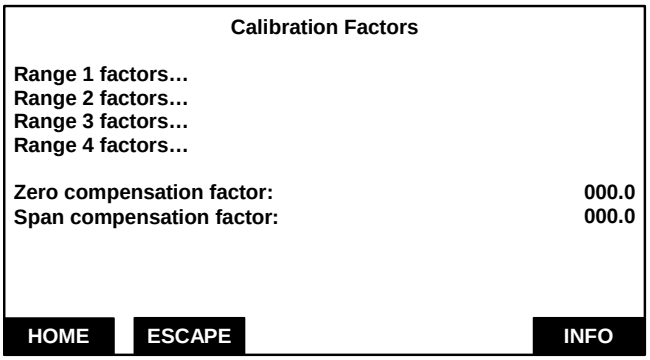
Menu: 48 LINRANGE0l1



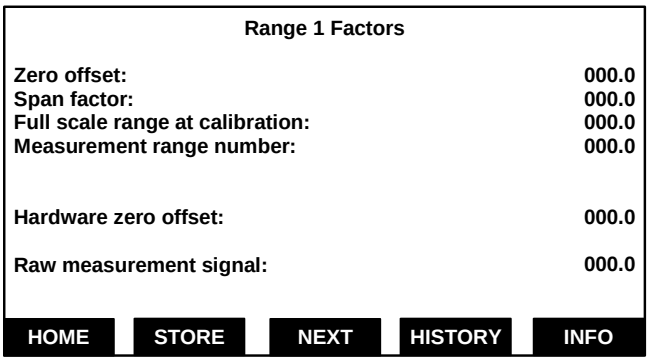
Menu: 49 PLMITSAl1



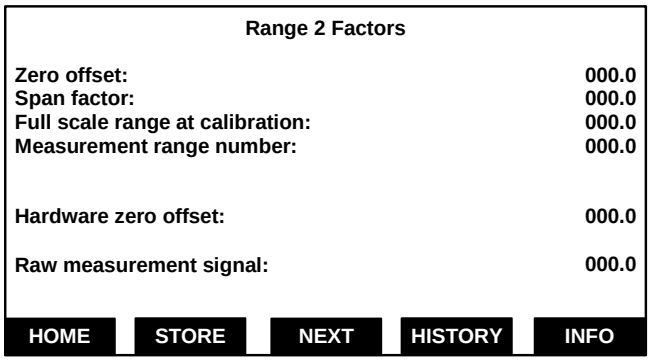
Menu: 50 CALFACTORS



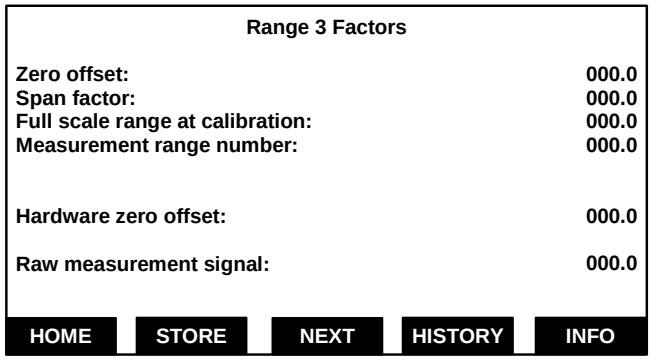
Menu: 51 R1FACTORS



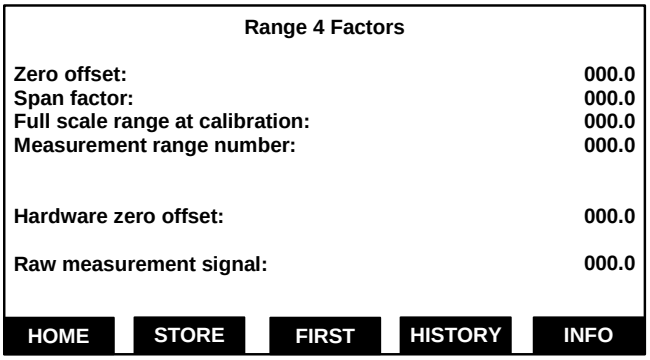
Menu: 52 RN2FACTORS



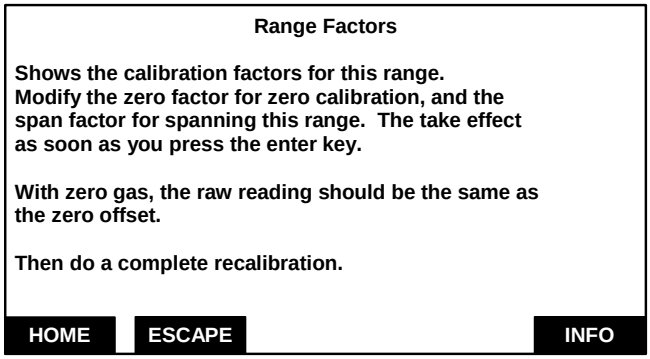
Menu: 53 RN3FACTORS



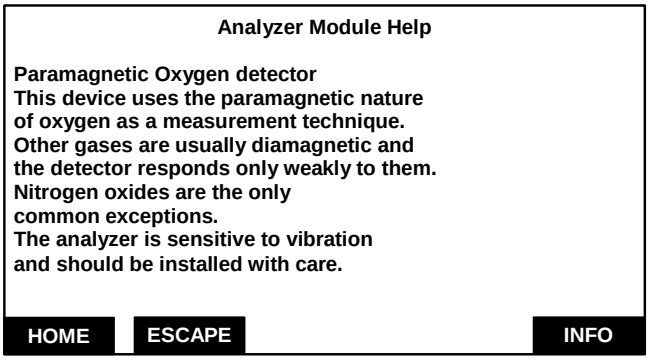
Menu: 54 RN4FACTORS



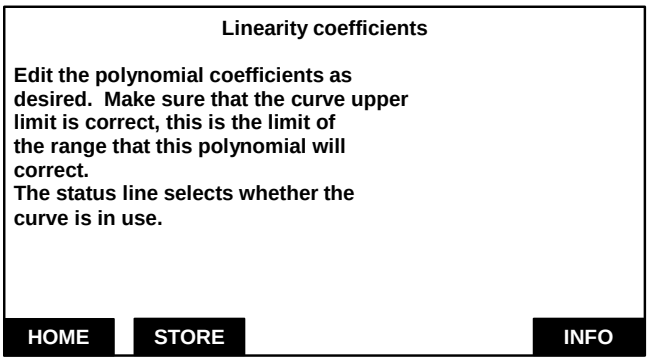
Menu: 55 RFACTORSl



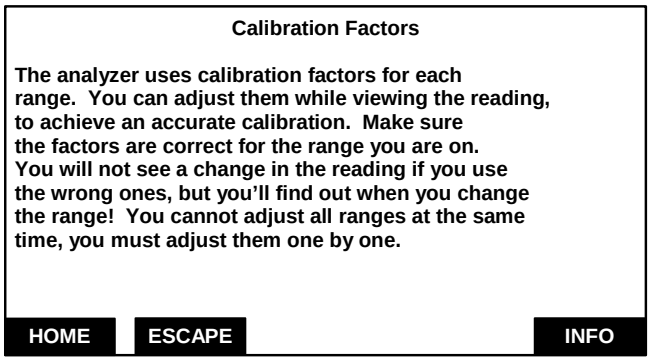
Menu: 56 AMHELPINDEX



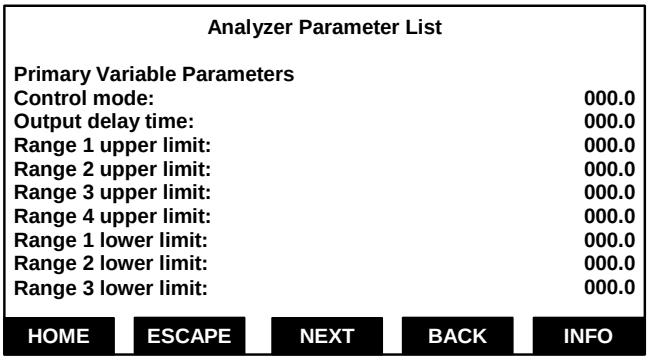
Menu: 57 LINRANGE1l1



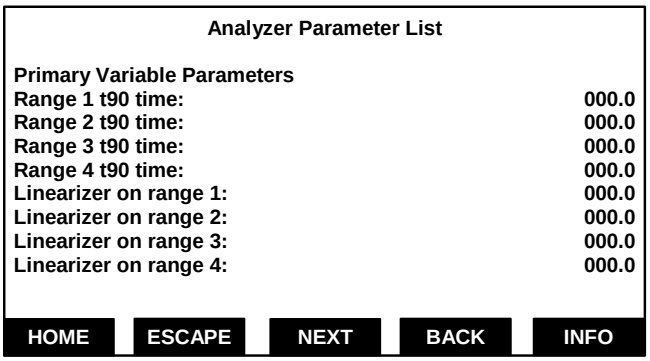
Menu: 58 CALFACTORSI1



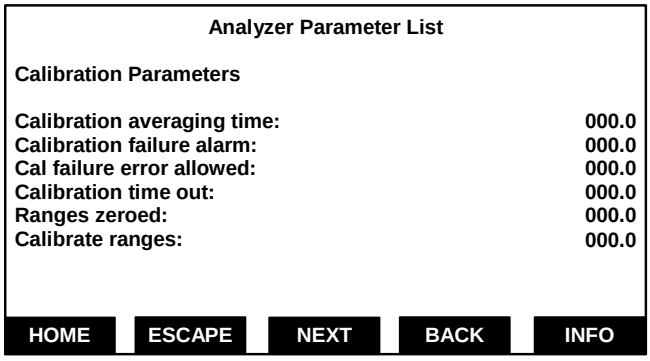
Menu: 59 APARLST2



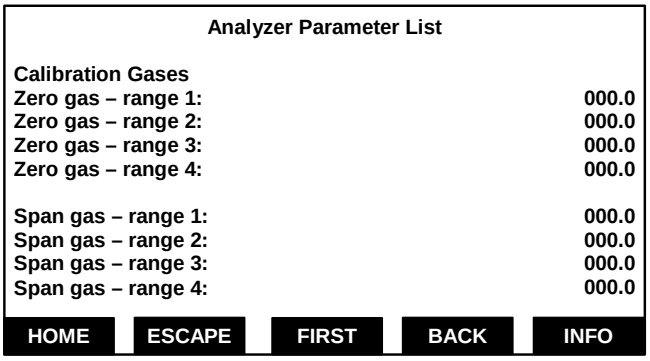
Menu: 60 APARLST4



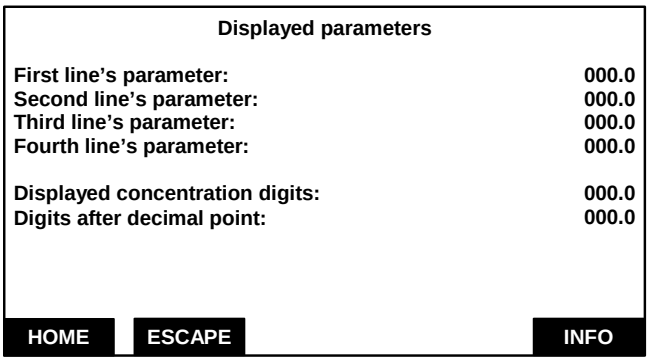
Menu: 61 APARLST5



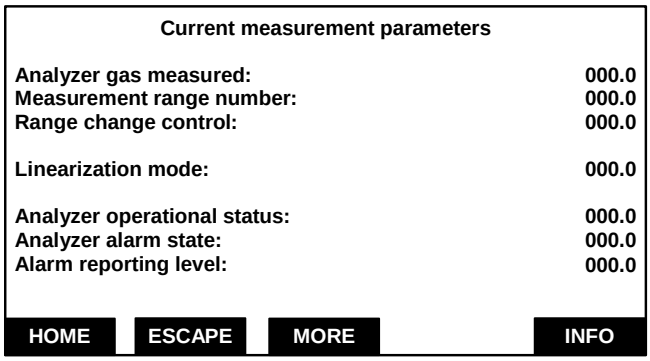
Menu: 62 APARLST6



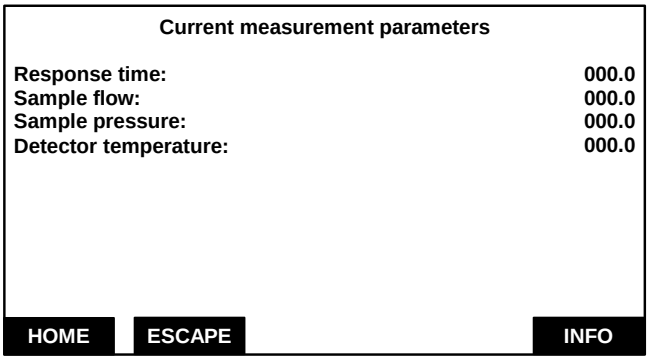
Menu: 63 DISPLAY



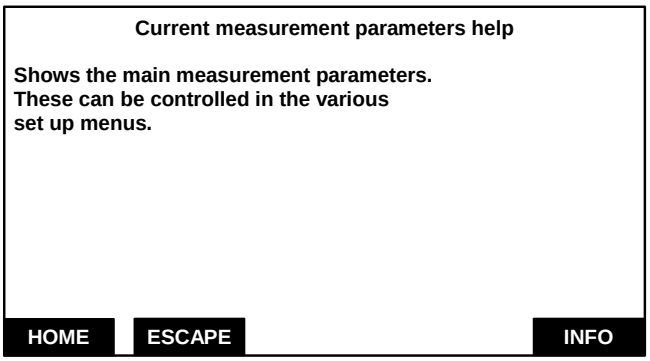
Menu: 64 MPARMS



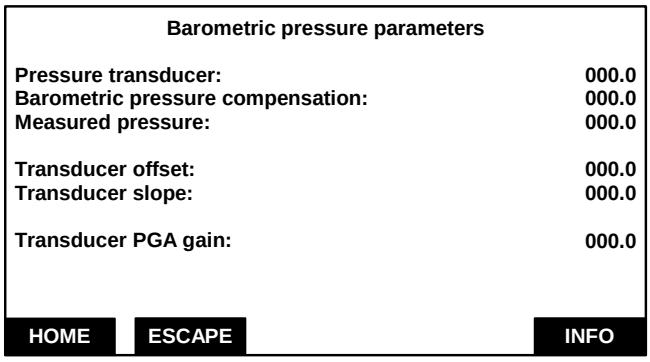
Menu: 65 MPARMS2



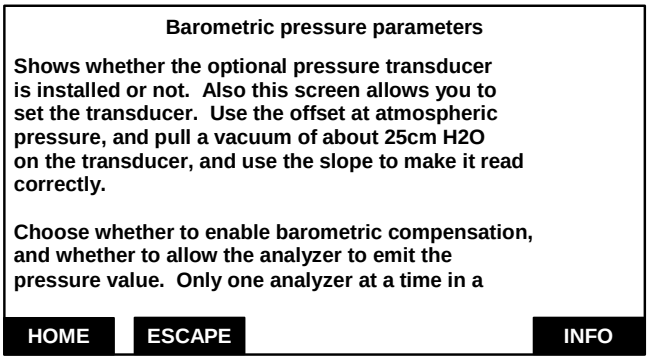
Menu: 66 MPARMSI1



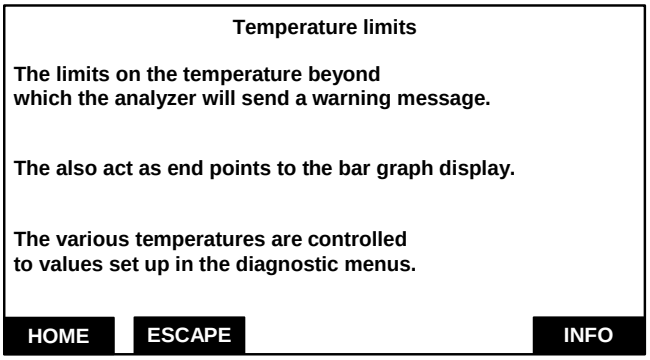
Menu: 67 BAROM_PARMS



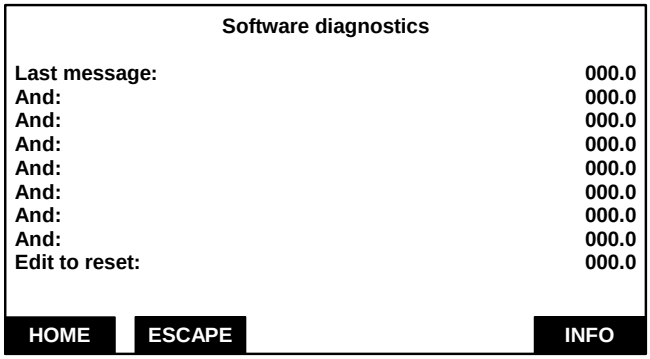
Menu: 68 BAROM_PARMI1



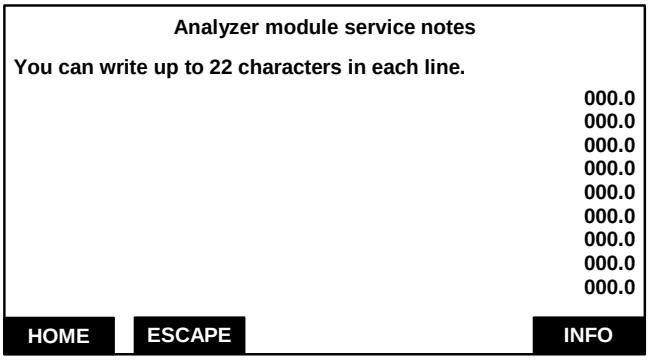
Menu: 69 TLIMITSIAI1



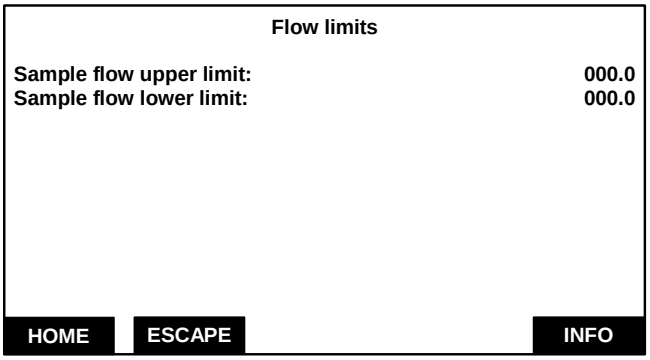
Menu: 70 SW_DIAG



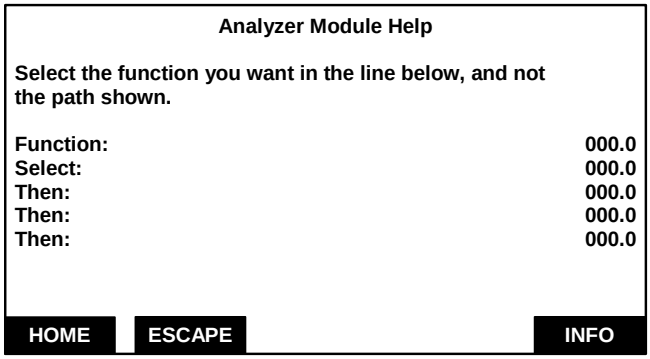
Menu: 71 LISTNOTES



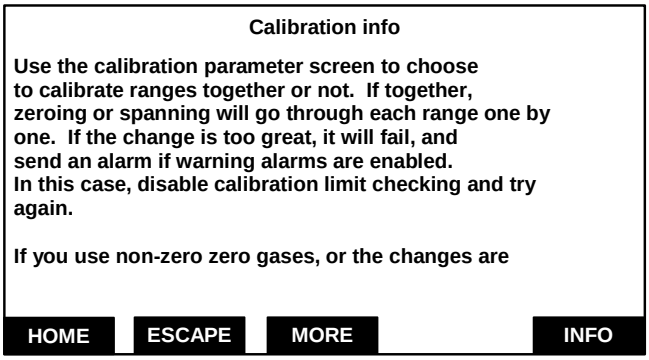
Menu: 72 FLOWLIMITS



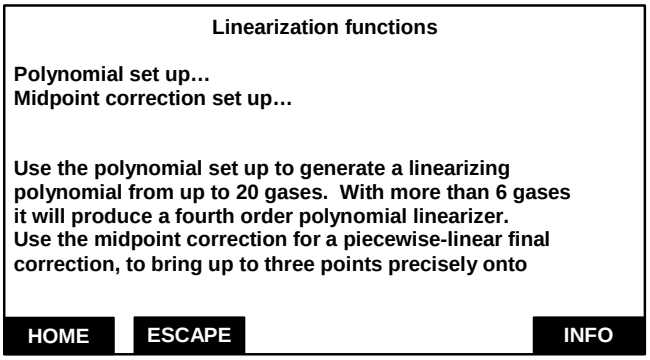
Menu: 73 AMPATH



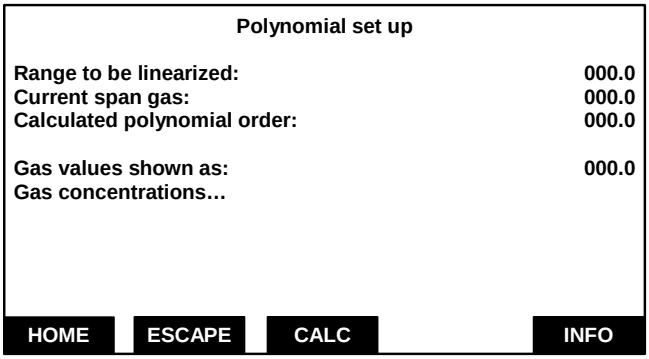
Menu: 74 CALI1



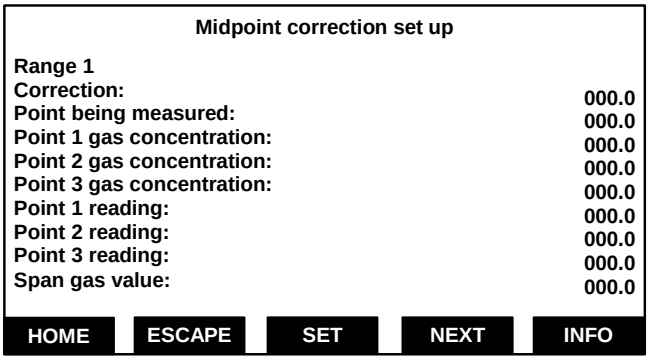
Menu: 75 LINFUNCT



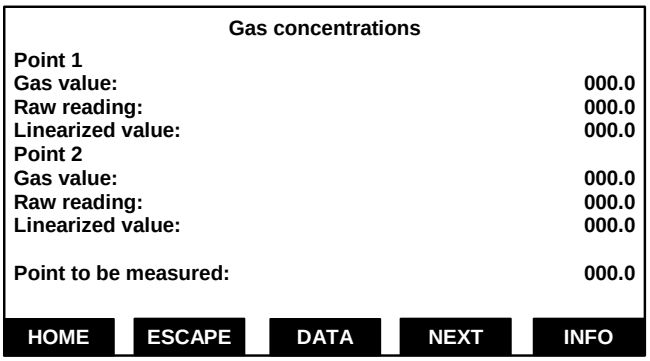
Menu: 76 POLYSETUP



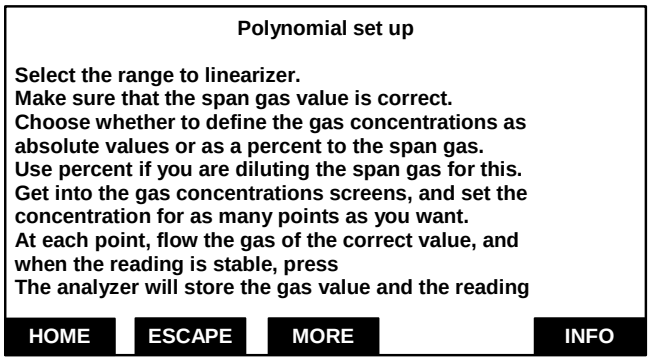
Menu: 77 MIDPOINT1



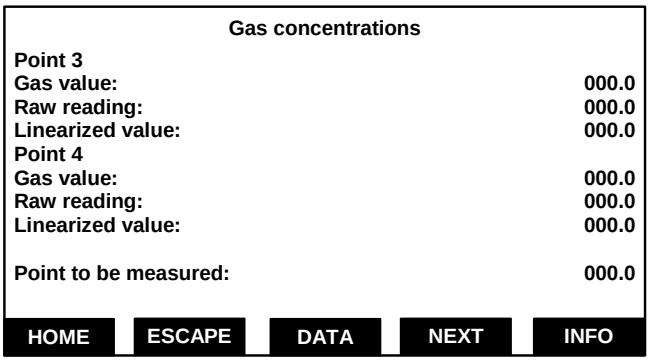
Menu: 78 POLYGAS1



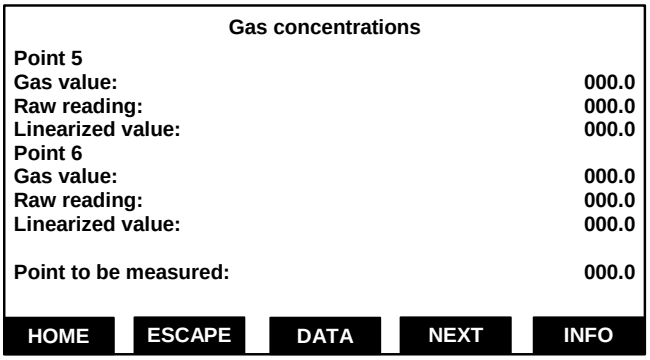
Menu: 79 POLYSETI1



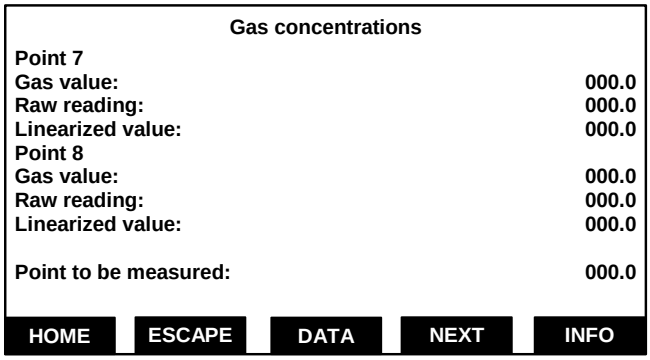
Menu: 80 POLYGAS2



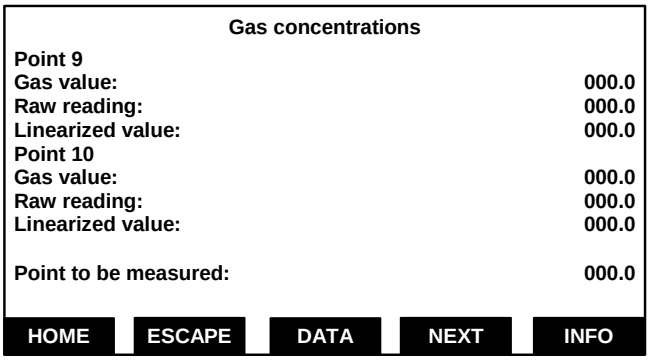
Menu: 81 POLYGAS3



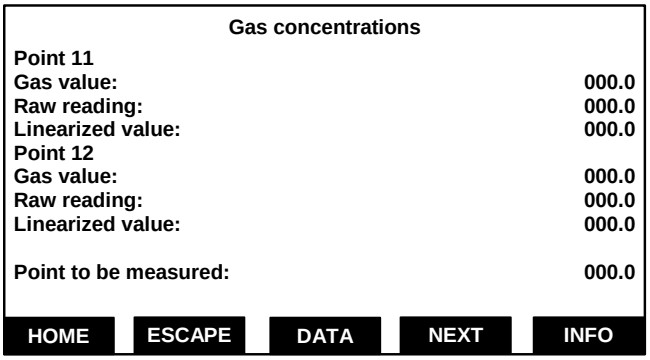
Menu: 82 POLYGAS4



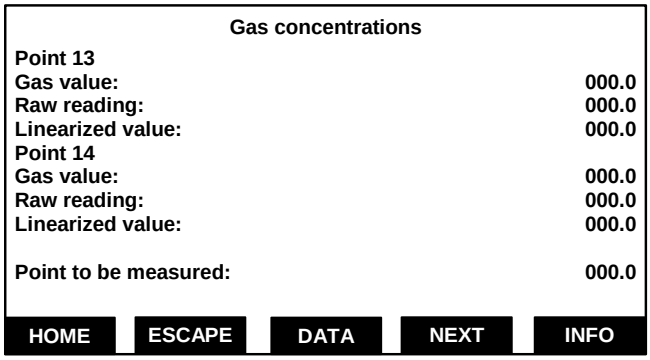
Menu: 83 POLYGAS5



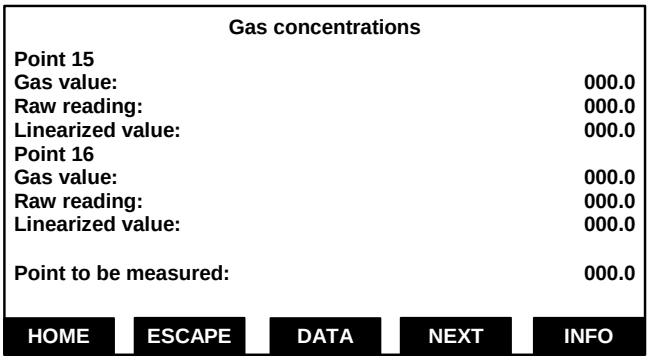
Menu: 84 POLYGAS6



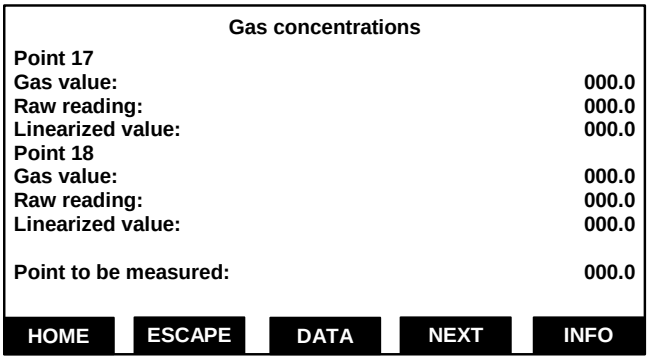
Menu: 85 POLYGAS7



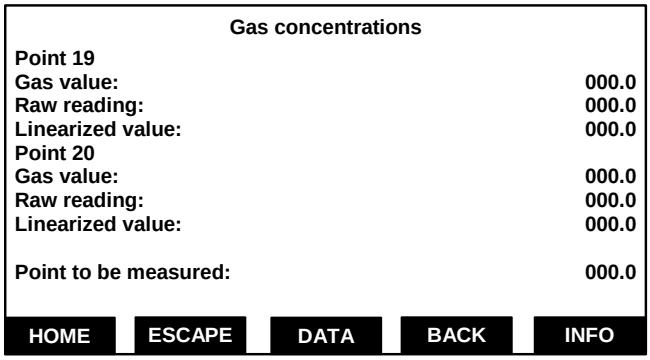
Menu: 86 POLYGAS8



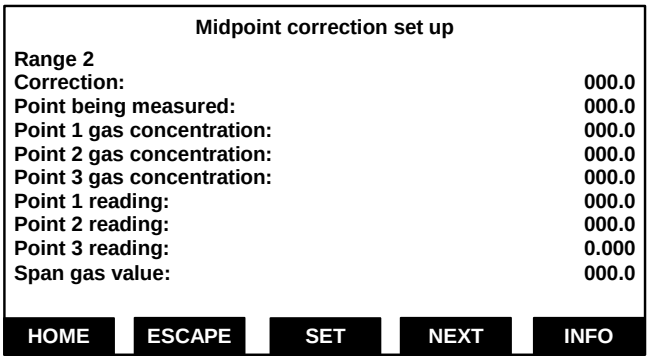
Menu: 87 POLYGAS9



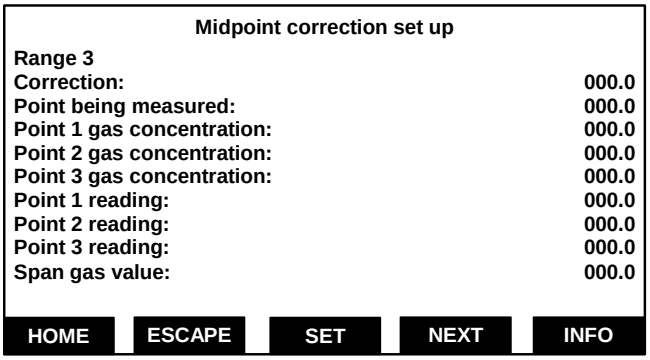
Menu: 88 POLYGAS0



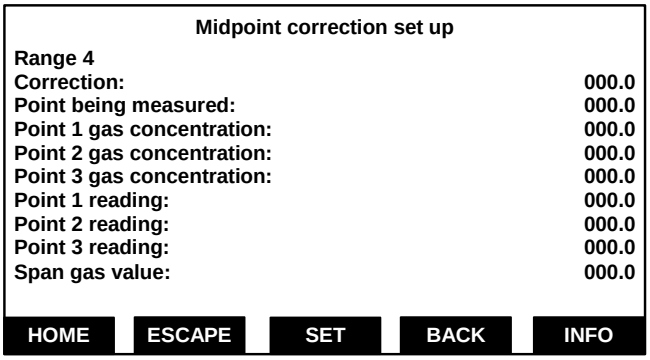
Menu: 89 MIDPOINT2



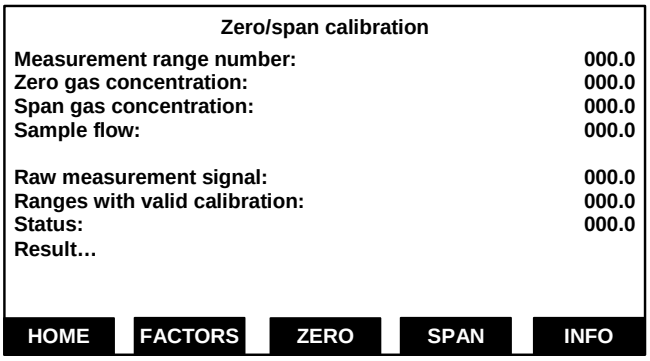
Menu: 90 MIDPOINT3



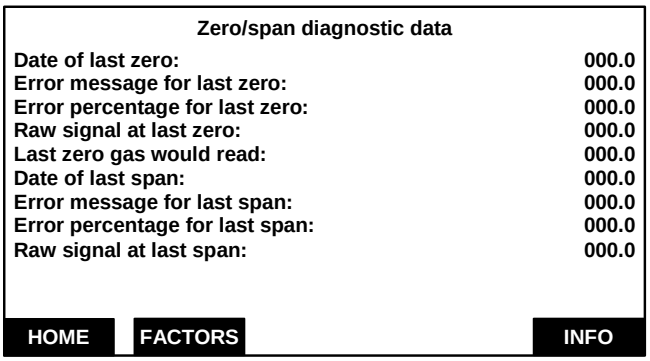
Menu: 91 MIDPOINT4



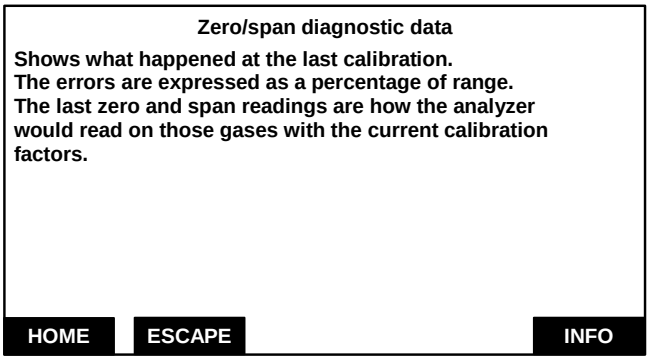
Menu: 92 EXP_CAL



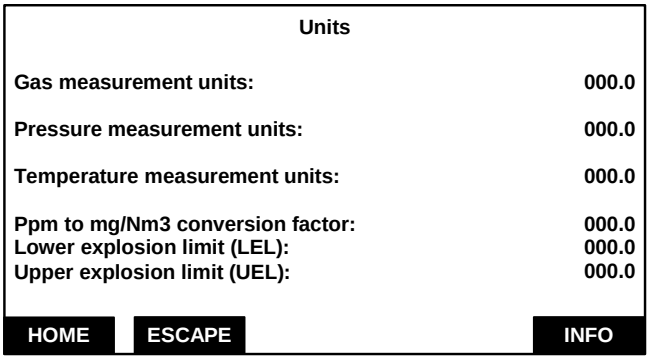
Menu: 93 EXP_CAL_DAT



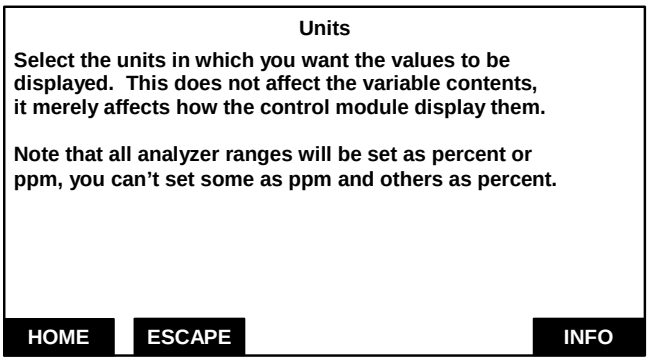
Menu: 94 EXP_CAL_DATI



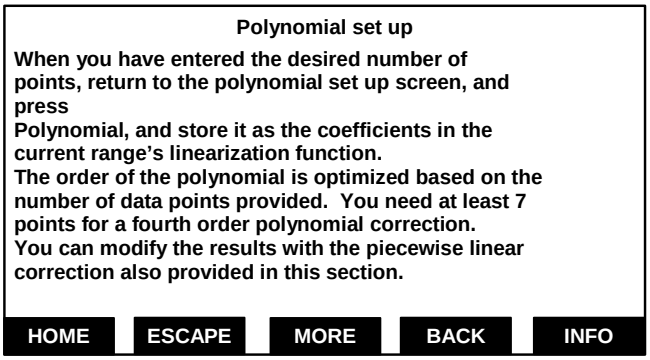
Menu: 95 UNITS



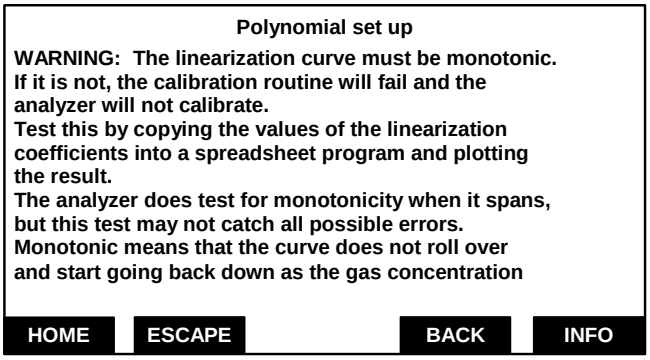
Menu: 96 UNITSI1



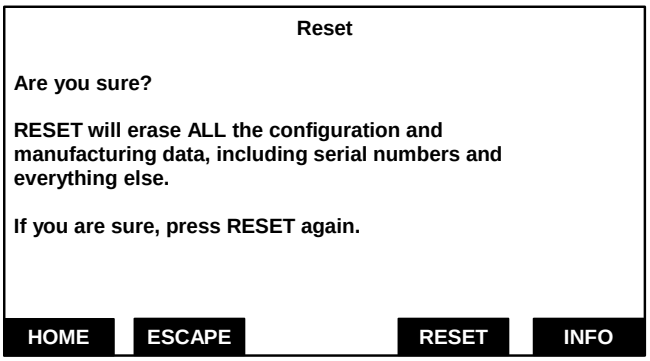
Menu: 97 POLYSETI2



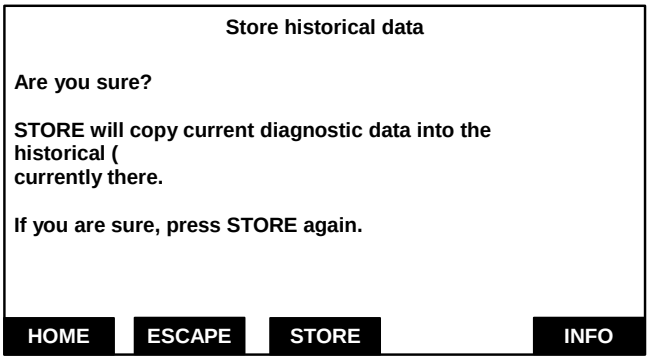
Menu: 98 POLYSETI3



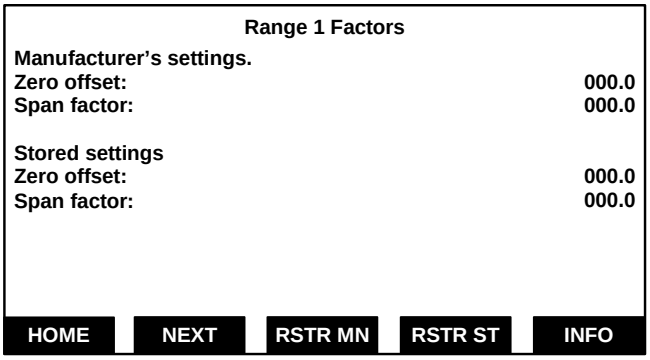
Menu: 99 RESET



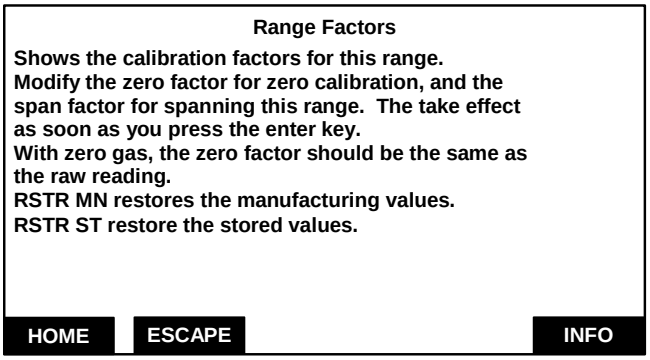
Menu: 100 STORE



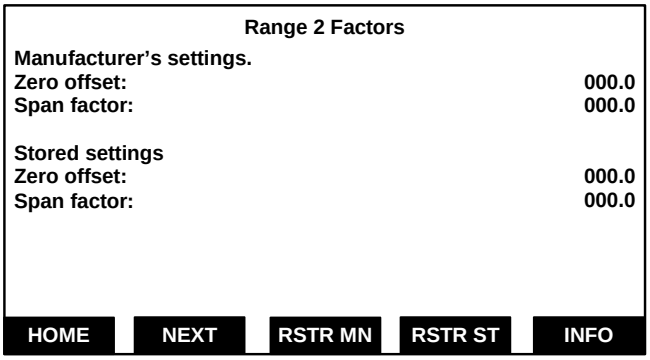
Menu: 101 RFHIST1A



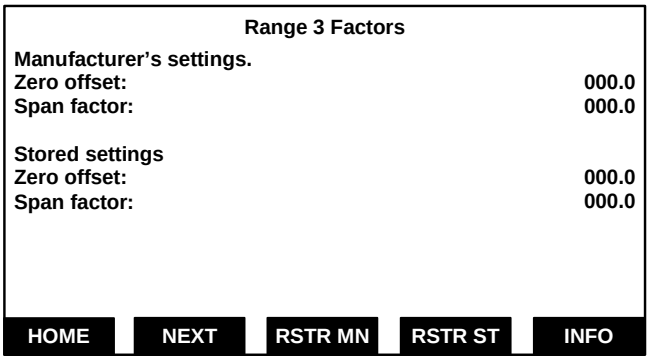
Menu: 102 RFACTORSIA



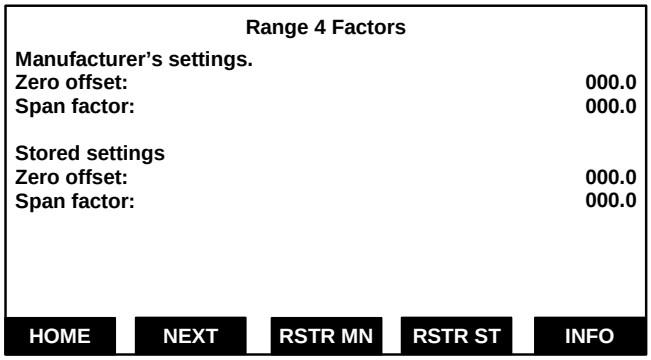
Menu: 103 RFHIST2A



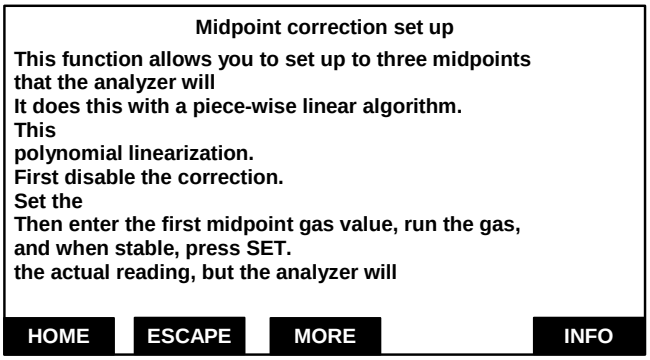
Menu: 104 RFHIST3A



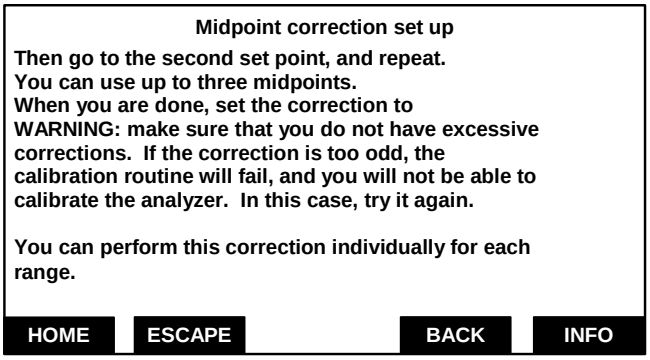
Menu: 105 RFHIST4A



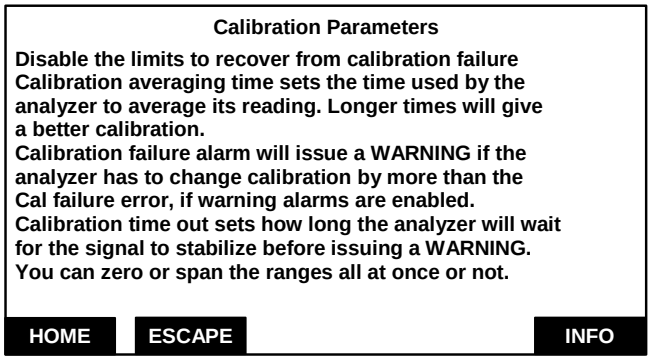
Menu: 106 TWEAKI1



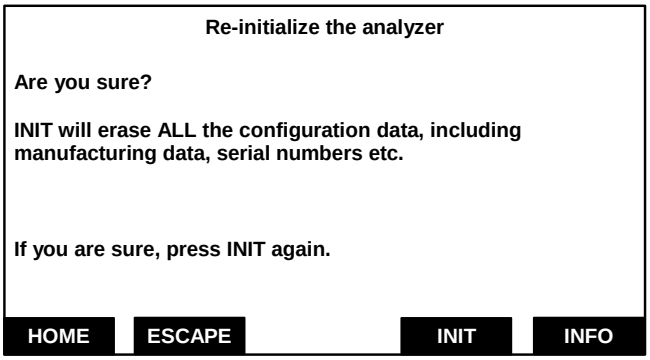
Menu: 107 ANALSETI3



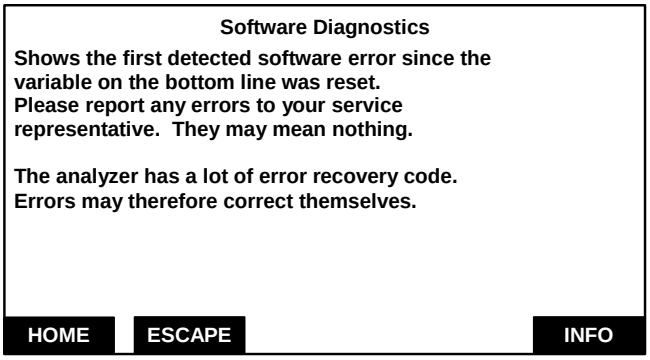
Menu: 108 ACALSETI1A



Menu: 109 INIT

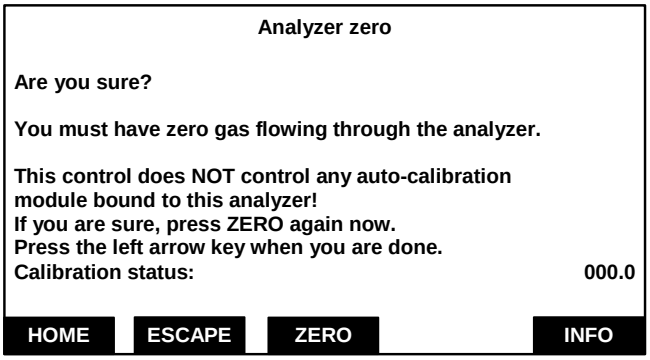


Menu: 110 SWDIAGI1

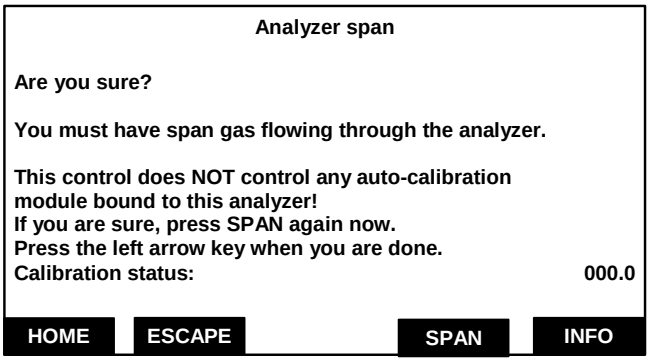


Menu: 111 STOREDPVA

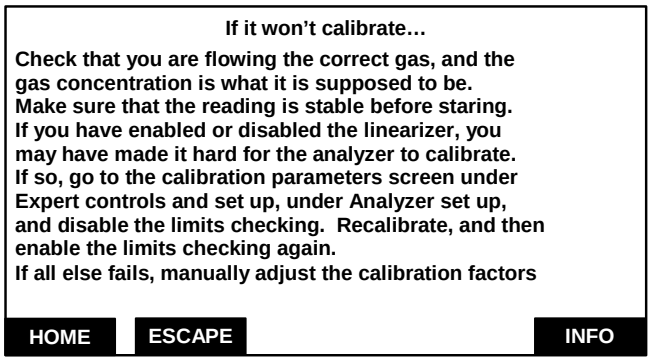
Menu: 112 ZERO_NOW



Menu: 113 SPAN_NOW

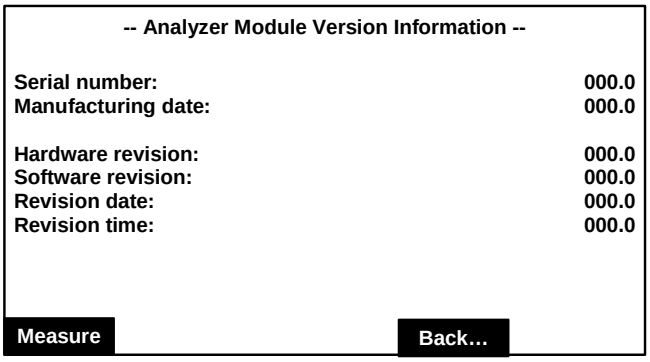


Menu: 114 CALFAIL

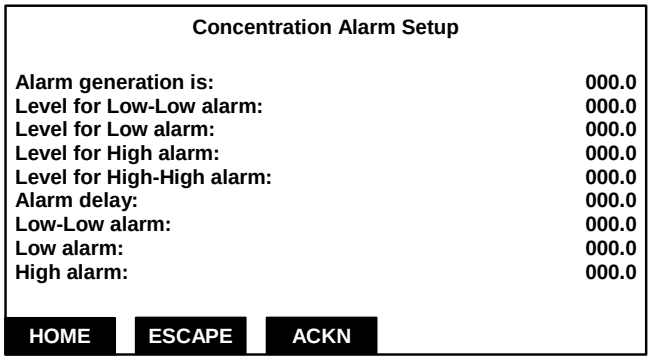


Menu: 115 ABOUT

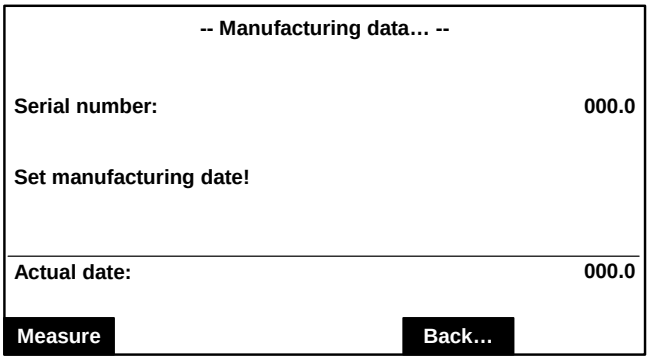
Menu: 116 ABOUT1



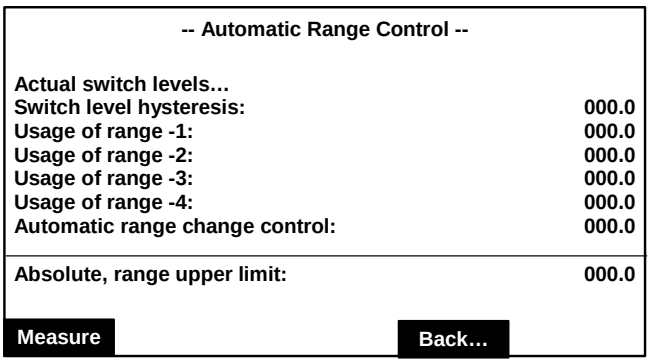
Menu: 117 ALARM1



Menu: 118 MANDATA



Menu: 119 AUTORANGE



VAISALA BAROMETRIC PRESSURE TRANSDUCER

This addendum serves as an amendment to the Model NGA 2000 PMD and NDIR instruction manuals. The following information should be considered part of the manual, if your instrument has a Vaisala Barometric Pressure Transducer installed in it, or if you are retrofitting a PMD or NDIR with a Vaisala transducer kit.

The Vaisala PTB100 series Analog Barometer is a N.I.S.T. traceable precision silicon capacitive atmospheric pressure transducer. The sensor delivers an analog voltage output that is inversely proportional to its inlet pressure. It has an operational ambient pressure range of 800 to 1060 hPa.

The original PMD and NDIR instruments were designed for use with a resistance bridge type of pressure transducer requiring an external gain amplifier with an offset trim The Vaisala transducer contains an integral gain amplifier that is scaled for a 0 to +5 Vdc output. The 661380 "Interface Board" contains the circuitry to convert the Vaisala single ended 0 to +5 V dc output into the referenced bridge 0 to +0.625 V dc output configuration that is required by the Analyzer module's Computer Analysis Board. The Vaisala transducer kit is backward compatible with the original Rosemount pressure transducer.

Vaisala Interface Board Circuit Function:

The Vaisala Interface Circuit board adapts the single ended analog output of the Vaisala sensor into a Precision Voltage referenced, balanced bridge (at 1 atmosphere) input configuration. A "Bridge Balance" pot on the Vaisala Interface Circuit board provides the fine trim "Bridge Balancing" calibration adjustment that is required to set up each individual transducer at a known ambient air pressure. Test points are provided on the circuit board for this adjustment.

The Vaisala transducer output range is 0 to +5 Vdc.

The Vaisala analog output voltage is inverted and fed into a balanced summing node that is referenced by a precision regulator. The summing node voltage is 0.000 Vdc at 1013 hPa (1 atmosphere ambient air pressure). The summing node voltage is then buffered, inverted, and gain reduced by a factor of 8 to produce the Pressure Compensation Output voltage at J12-1 for the Computer Analysis board.

Low noise, Low input current offset Op-Amps, and common substrate resistors are used to reduce gain tracking errors and null thermal coefficient effects.

1-1 INSTALLATION & RETROFIT INSTRUCTIONS

1. Remove the original Rosemount transducer circuit board assembly, located on the motherboard at J12 and J13 (if present).
2. Install the transducer with the pressure inlet facing the rear of the instrument using the mounting studs provided on left-hand side of the detector housing.
3. Install the Interface board into it's mating sockets (J12 and J13) on the motherboard.
4. Connect the 4-pin cable (P1) from the interface board (noting pin polarity) to the Vaisala Pressure Transducer.

5. Connect the instrument sample inlet tubing to the Vaisala Pressure Inlet port.
6. Enable the Barometric Pressure Compensation and the Use Local Reading options via the Expert Controls – Analyzer Module Diagnostics – Barometric Pressure Compensation menus of the instrument. The instrument will automatically detect and report the 'Presence' of the Pressure Compensation Option.

1-2 ADJUSTMENT PROCEDURE

Circuit adjustment can be made using Barometric Pressure menu display, or an external Digital voltmeter.

Display Method

With no sample inlet lines connected and the instrument exhaust ported to atmosphere, adjust R1 on the 661380 Interface board until the Barometric Pressure reading on the Barometric Pressure menu reads the correct ambient air pressure.

DMM Method

Connect the DMM (+) to TP1 on the 661380 Interface board, (-) to TP2. Set the DMM to measure mVDC. With no sample inlet lines connected and the instrument exhaust ported to atmosphere, adjust R1 on the Interface board until the DMM reads 0.000 Vdc $\pm$ 0.001 V. The instrument is now calibrated at 1 ATM.

1-3 HIGH ALTITUDE VERSION OPTION

For applications where the instrument is to be used above 5400 Feet (MSL) an alternate transducer option is available from the factory. This version consists of a Vaisala model PTB100B transducer (900-1100 hPa range). Please contact the factory if you require this option.

WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, glass electrodes, membranes, liquid junctions, electrolyte, o-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty, or from any other cause. All other warranties, expressed or implied are hereby excluded.

IN CONSIDERATION OF THE HEREIN STATED PURCHASE PRICE OF THE GOODS, SELLER GRANTS ONLY THE ABOVE STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitations of Remedy. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL SELLER'S LIABILITY EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TO INCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENT SHALL SELLER BE OBLIGATED TO INDEMNIFY BUYER IN ANY MANNER NOR SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER, ITS ASSIGNS, AND EACH SUCCESSOR INTEREST TO THE GOODS PROVIDED HEREUNDER.

Force Majeure. Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

Instruction Manual
760007-A
July 2003

Model NGA2000 PMD

EMERSON PROCESS MANAGEMENT

ROSEMOUNT ANALYTICAL INC.
Process Analytic Division
1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
E gas.csc@emersonprocess.com

EUROPEAN TECHNOLOGY CENTER
Fisher-Rosemount GmbH & Co.
Industriestrasse 1
63594 Hasselroth
Germany
T 49-6055-884 0
F 49-6055-884209

ASIA - PACIFIC
Fisher-Rosemount
Singapore Private Ltd.
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T 65-777-8211
F 65-777-0947

EUROPE, MIDDLE EAST, AFRICA
Fisher-Rosemount Ltd.
Heath Place
Bognor Regis
West Sussex PO22 9SH
England
T 44-1243-863121
F 44-1243-845354

LATIN AMERICA
Fisher - Rosemount
Av. das Americas
3333 sala 1004
Rio de Janeiro, RJ
Brazil 22631-003
T 55-21-2431-1882

http://www.processanalytic.com

EMERSON.
Process Management